

# Radio Fun

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"The beginners guide to the exciting world of radio"

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## SAREX Launch

The Space Shuttle *Atlantis*'s mission, designated STS-71, carried the Shuttle Amateur Radio EXperiment or SAREX. Astronauts Ellen S. Baker and Charlie Precourt are both amateur radio operators. Ellen previously used ham radio from aboard the Shuttle *Columbia* during STS-50 in June 1992, and her call sign is KB5SIX. Charlie is KB5YSQ and also operated SAREX from *Columbia* during STS-55 in April 1993.

The crew had scheduled voice contacts with 4 school groups in the US and one in Russia. The crew made random contacts with the amateur radio community as their busy schedules permitted. Landing was to be July 4 at the Kennedy Space Center in Florida, but was delayed until at least July 8.

The crew operated 2 meter FM voice only, using a radio which also facilitated a rendezvous and docking with the Russian Space Station *Mir*. The shuttle carried two new *Mir* crew members (*Mir* 19) to the station, and will return to Earth with the three *Mir* 18 crew members (Vladimir Dezhurov, Gennadiy Strekalov, and US astronaut Norm Thagard). This mission is the first of at least seven shuttle flights to *Mir*. The effort is a precursor to building the International Space Station.

Most of the SAREX activities were after the Shuttle separated from *Mir* on July 1.

A different set of frequencies were

used for this SAREX mission. The astronauts operate split, transmitting and receiving on separate frequencies. The FM voice downlink was 145.84 MHz. The FM voice uplinks were 144.45 and 144.47 MHz.

TNX ARRL through the usenet newsgroup rec.radio.amateur.space

### PHASE 3-D LAUNCH SCHEDULE CHANGED

Reports in the space press, and confirmed by ESA officials, state that the launch of Ariane 502, the mission on which Phase 3-D is manifested, is now set for May 29, 1996, rather than April 3, 1996, as it had been. This follows a reschedule of

the first launch in the Ariane 5 series, Ariane 501, from November of this year to mid-January 1996. TNX AMSAT

### NEW ZEALAND GOVERNMENT SEEKS TO DROP MORSE

Despite previous assurances to its national radio society (NZART), the government of New Zealand has announced that it will seek to delete RR2735 (the Morse code requirement) of the Radio Regulations at the next World Radio Conference (WRC95) in Geneva in October. TNX *Morsum Magnificat*



All civilian aircraft operating across national borders must have a callsign. See story on page 5 for more information.

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MODEL VS-50M

# **ASTRON POWER SUPPLIES**

**• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •**

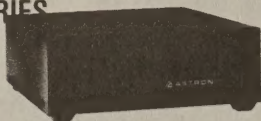
## **SPECIAL FEATURES**

- SOLID STATE ELECTRONICALLY REGULATED
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- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
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- RIPPLE Less than 5mv peak to peak (full load & low line)
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### **• LOW PROFILE POWER SUPPLY •**

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
SL-11A	• •	7	11	2 1/2 x 7 1/8 x 9 3/4	12
SL-11R	• •	7	11	2 1/2 x 7 x 9 3/4	12
SL-11S	• •	7	11	2 1/2 x 7 1/8 x 9 3/4	12
SL-11R-RA	• •	7	11	4 3/4 x 7 x 9 3/4	13

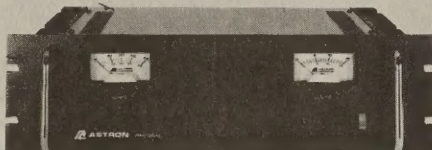
## **RS-L SERIES**



### **• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE**

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-4L	3	4	3 1/2 x 6 1/8 x 7 1/4	6
RS-5L	4	5	3 1/2 x 6 1/8 x 7 1/4	7

## **RM SERIES**



MODEL RM-35M

### **• 19" RACK MOUNT POWER SUPPLIES**

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12A	9	12	5 1/4 x 19 x 8 1/4	16
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
RM-60A	50	55	7 x 19 x 12 1/2	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5 1/4 x 19 x 8 1/4	16
RM-35M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50M	37	50	5 1/4 x 19 x 12 1/2	50
RM-60M	50	55	7 x 19 x 12 1/2	60

## **RS-A SERIES**



MODEL RS-7A

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-3A	• •	2.5	3	3 x 4 3/4 x 5 3/4	4
RS-4A	• •	3	4	3 3/4 x 6 1/2 x 9	5
RS-5A	• •	4	5	3 1/2 x 6 1/8 x 7 1/4	7
RS-7A	• •	5	7	3 3/4 x 6 1/2 x 9	9
RS-7B	• •	5	7	4 x 7 1/2 x 10 3/4	10
RS-10A	• •	7.5	10	4 x 7 1/2 x 10 3/4	11
RS-12A	• •	9	12	4 1/2 x 8 x 9	13
RS-12B	• •	9	12	4 x 7 1/2 x 10 3/4	13
RS-20A	• •	16	20	5 x 9 x 10 1/2	18
RS-35A	• •	25	35	5 x 11 x 11	27
RS-50A	• •	37	50	6 x 13 3/4 x 11	46
RS-70A	• •	57	70	6 x 13 3/4 x 12 1/8	48

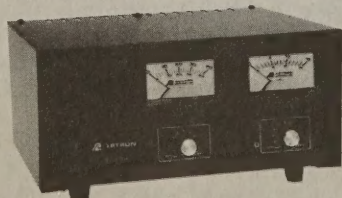
## **RS-M SERIES**



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4 1/2 x 8 x 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 3/4 x 11	46
RS-70M	57	70	6 x 13 3/4 x 12 1/8	48

## **VS-M AND VRM-M SERIES**

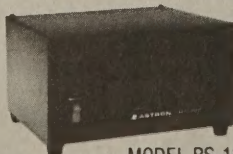


MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable, from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	@13.8VDC @10VDC @5VDC	@13.8V		
VS-12M	9 5 2	12	4 1/2 x 8 x 9	13
VS-20M	16 9 4	20	5 x 9 x 10 1/2	20
VS-35M	25 15 7	35	5 x 11 x 11	29
VS-50M	37 22 10	50	6 x 13 3/4 x 11	46
VS-70M	57 34 16	70	6x13 3/4 x 12 1/8	48
• Variable rack mount power supplies				
VRM-35M	25 15 7	35	5 1/4 x 19 x 12 1/2	38
VRM-50M	37 22 10	50	5 1/4 x 19 x 12 1/2	50

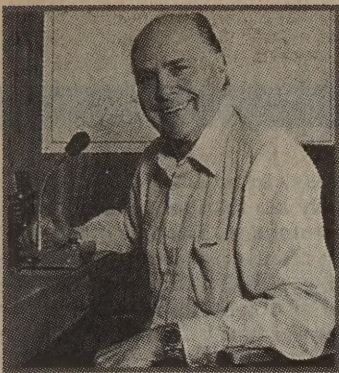
## **RS-S SERIES**



MODEL RS-12S

### **• Built in speaker**

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-7S	• •	5	7	4 x 7 1/2 x 10 3/4	10
RS-10S	• •	7.5	10	4 x 7 1/2 x 10 3/4	12
RS-12S	• •	9	12	4 1/2 x 8 x 9	13
RS-20S	• •	16	20	5 x 9 x 10 1/2	18
SL-11S	• •	7	11	2 3/4 x 7 1/8 x 9 3/4	12



# QLF

by Wayne Green WNSD/1

## Ham History

The recent Silent Key announcements for Bill Leonard W2SKE and Stu Meyer W2GHK, both around my age, got me to remembering some ham history that few hams today probably know about. Bill used to be the president of CBS News and Stu was the president of Hammarlund. Both were good friends.

Bill and I spent a couple of months flying around the world together in 1959 on an Air Force C-54. We had a sideband ham station with us on the plane with which we made thousands of contacts as we flew from New Jersey to Newfoundland, Bermuda, The Azores, Scotland, Paris, Haderslev, Denmark, Berlin, Rome, Athens, Alexandria in Egypt, Aden, Karachi, Colombo in Sri Lanka, Bangkok, Saigon, The Philippines, Naha in Okinawa, Taipei, Seoul, Tokyo, Guam, Wake Island, Honolulu, Travis AFB, CA, Omaha, Dayton, Washington, DC, and back to New Jersey. We got to know each other pretty well.

My story has to do with the New York World's Fair of 1964-65 and the ham radio exhibits therein. I'll tell the story as I recall it rather than digging out my old issues to get the details exact.

It all started when Bill Leonard, who was quite a celebrity as the head of CBS News, found out that Coca-Cola was looking for a theme for their World's Fair pavilion. Bill called the president of Coca-Cola and suggested that the exhibit be built around amateur radio, which was at that time a fast-growing hobby, delivering thousands of engineers, technicians, and scientists into the workplace to support and further the American world leader-

ship in electronics and communications. When Coke bought the idea, Bill put them in touch with the ARRL to implement it. This was going to be the biggest publicity coup for the hobby in history! Millions of people would get to see ham stations in operation and be

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***"I know you're not going to believe this, but the League fought the ham manufacturer's group all the way."***

---

able to send messages home to their family and friends from the Fair. There would be booklets explaining about ham radio and telling people how they, too, could enjoy this wonderful and educational hobby. Lonely? Not when you can turn on a switch and talk with people anywhere in the world!

The plans for having a dozen or so operating ham stations in a large operating area as the main theme for the Coke exhibit unraveled when word leaked out that, in return for a large under-the-table donation to the League's Building Fund, the exhibit would use only Hallicrafters' equipment. The other manufacturers were outraged, as was Coca-Cola. So amateur radio ended up with a small out-of-the-way room up on the second floor of the pavilion, next to the toilets, and only reachable via a small stairway. Instead of millions of visitors seeing amateur radio at work and having messages sent for them, it was viewed by hundreds.

Could visiting hams get to operate? Har-de-har. I got a lot of angry letters about that from frustrated hams who'd managed to find the place, but had to stand outside the little room and look in.

Stu Meyer, the president of Hammarlund, was particularly upset over the sell-out of the hobby by the League, so he formed a manufacturer's group and went to other Fair exhibitors, looking for a place to show off amateur radio. He found it with the Venezuelan pavilion, which offered some space on the main floor of their exhibit.

In order to get a license for the station, they needed a ham club to back it. They found one in New York City that was game. I know you're not going to believe this, but the League fought the ham manufacturer's group all the way. They got Herb Hoover, Jr, the ARRL president, to go to Venezuela and try to convince the president of the country to close down the ham exhibit. They even tried to get the FCC to close it down due to some claimed irregularities in the sponsoring ham club's election process.

The chap who did most of the leg work on the alternative ham station for the Fair was W2AOE, who got so upset over the ARRL moves to shut down the exhibit that he committed suicide. He took things too seriously.

Amateur radio did get exposure at the Venezuelan pavilion, but nothing like we would have had if we'd been the central feature at the Coca-Cola exhibit. Little did the folks at Hallicrafters know that they would be put out of business (along with Hammarlund and just about everyone else in the ham industry) within three years as a result of the ARRL's self-promoting "Incentive Licensing" proposal.

I hope you enjoyed my bit of ham history. I'm sure it will anger the brainwashed who truly believe the League can do no wrong. **RF**

## AUGUST 1995

ISSUE #48

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RADIO FUN (ISSN 1055-887X) is published monthly by Radio Fun, a division of Wayne Green, Inc., 70 Route 202-N, Peterborough NH 03458. Subscriptions: \$14.00 per year. Canada add \$8.00. Foreign add \$12.00 surface/\$32.00 airmail. Second class postage pending at Peterborough NH and additional mailing offices.

Printed in the U.S.A.

POSTMASTER: Send address corrections to RADIO FUN, 70 Route 202 N, Peterborough, NH 03458

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Reprints: \$2.00 per article.

Back issues: \$3.00 each.

**William Thim, Jr. N1QVQ** After reading your commentaries over the past several years, I find myself agreeing with you on the issue of CW. I have heard from hams who want to totally abolish the code requirements and the laws mandating them, to hams who want the status quo to continue. My view is that there should be a requirement of 5 wpm only, no 13 and 20 wpm requirements. Just one test for 5, then the standard written test for upgrades. My reasoning is twofold: 1) With more and more ham shacks having computers, the majority will soon, if not already, be sending code via keyboard/software, at which point it will not matter if you can copy at 5 wpm or 55 wpm; the only thing that will matter is how fast you can type and the quality of your software. 2) If you enjoy CW, you will increase your speed through on-air contacts, not enforcement. While the wording of the international requirements states a proficiency in CW, there is no mention of speed requirements.

So if there were a 5-wpm requirement only, the "old timers" would still have the code to keep our bands from turning into CB. Also it would satisfy all legal requirements to keep the lawyers happy. I would enjoy feedback, pro and con. We can only grow with multiple input. Packet address N1QVQ@K1MEA.#WMA. MA.USA.NA

**Mark Julicher WX3O** The March/April edition of *Radio Fun* had (in my humble opinion) an excellent "QLF" editorial. I think you may be interested in some of the things my wife Kathleen N9QOF and I are doing as more or less kindred spirits.

Our Lousy Schools. Well, in short, we home-schooled our four children. Two are graduating from excellent colleges this year (Rice and Rose-Hulman). A third will start college next fall. This is not a brag; we just got fed up and took our kids out of the worthless baby-sitting service known as school. Yep! We took a lot of "gas" from family and friends, but now many of them are paying us to hear a seminar on how to do high school at home. We could easily spend months traveling and lecturing but we don't have time.

One of the ways our taxes were squandered in the 60s until now is to buy science books that require "cosmic" equipment in the school lab. Unbelievable! We have megabucks in the lab, kids that don't have a clue, and one teacher in a dozen that can use the equipment anyway. I could go on, but I'll get writer's cramp.

Needless to say, few people can afford a cosmic lab for home school. No problem—we started a company (Castle

Heights Press) to write science books, and especially lab manuals, based on inexpensive equipment. Many of our experiments were resurrected from old science books, that is, 1900-1950! Many people have looked at our product and consider the material too hard! I doubt if you are surprised.

By the way, we used our own kids as test subjects for the books: N9RGK, N9RLH, N9WXU, and no call (damn).

Please consider for your bookshelf: *Government Nannies*, *The Cradle to Grave Agenda of Goals 2000*, and *Outcome Based Education*. Cathy Duffy, Noble Publishing Co. Associates, P.O. Box 2250, Gresham OR 97030. Phone: (503) 667-3942. \$19.95 Not everyone is able to home-school, but they can perform the greatest single act of advanced child-rearing known to man: *Cut the power cord off the TV*.

We can't afford hired help yet, so publishing is a full-time job (why are you not surprised?). We manage to home-school and lead a full life, which really means a full schedule. Meanwhile, I just retired from the USAF and took a job with LINK (flight simulators). Writing more books is an evening activity.

What's up in ham radio? There are interesting doings at Rose Hulman Institute of Technology (Terre Haute, IN). The undergrads at Rose are building Solar Phantom III to race in this year's SUN-RAYCE '95. Sunrayce lasts ten days and goes from Indy to Golden, CO. Most of the race team and every Phantom driver is a ham. The race car is linked to a chase van and other support vehicles via 2m voice, and spread spectrum telemetry in the 900 MHz band. The chase van uses the telemetry in a PC to work out optimum race strategy. The chase van also has a GPS APRS packet station. The students have constructed maps for the APRS covering the race route (highways 40 and 36).

There are many colleges in the race. Rose is not the only group using radios, but many are using business band. The Solar Phantom team uses a mix of ham plus low-power stuff in unlicensed bands. The telemetry computer was designed and built from scratch (ok, that is a little brag because it was my son's Senior project). My son and the rest of the Solar Phantom team got ham tickets because they needed the flexibility offered by amateur radios. None of them had study time to learn code; they were too busy creating new technology.

I get paid tomorrow and I guarantee I'm getting a subscription to 73 and probably a couple of books from the Bookshelf. We are doing our part to get America off its butt! Thought you might like to know.

# Radio Callsigns

by Roald Steen AJØN/LA6US

**T**he radio calls assigned to amateur radio operators, broadcast stations, and other radio transmitters are part of an international system. This system was developed in the 1920s by the International Radio Telegraph Union, a predecessor to the International Telecommunications Union.

## Beginning the Callsign System

It was the emerging need for clear identification of radio transmissions across national borders that forced the introduction of an international call sign system. Effective billing procedures, enforcement of rules and regulations, and frequency management depended upon clear identification of each radio transmitter. Ships at sea and aircraft adopted the same international identification system, since these mobile units use two-way radio for communications.

The early radio callsign system included evidence of the political situation in the world as this system was devised. Countries that were important world powers at the time received huge blocks of callsigns, in contrast to other nations that were less prominent. The United States, for example, received an ample supply of callsigns that included everything under the letters K, N, and W in addition to the callsign series AA to AL. The United Kingdom and

France, which were the two leading colonial powers of the time, also received huge allocations of call letters. The British allocation included the letters G and M and blocks of callsigns beginning with the letters V and Z. Some of the British callsign series have since been allocated to independent countries that are members of the British Commonwealth.

The original international callsign system simply went from letters A to Z. An exception was the letter Q. No nation was allocated any call sign beginning with Q, in order to avoid confusion with the Q codes. The Q codes were more important back then when radio communications mainly relied on Morse code communications. The callsign system had to be expanded as many new nations became independent following the Second World War. At first, callsigns beginning with numbers were adopted to accommodate new nations.

Even the United Nations received a series of callsigns under this expanded system, from 4UA to 4UZ. The International Civil Aviation Administration and the World Meteorological Organization are two other international organizations with their own callsign series. Eventually, even this system became insufficient to accommodate all nations that achieved independence. Callsigns

beginning with a letter, followed by a number, became the next step in the identification system. For example, the new nation of Cape Verde was allocated the callsign series D4A to D4Z upon achieving independence in 1975, and the Bahamas were allocated the callsign series C6A to C6Z when this beautiful island nation became independent in 1973.

## Planes and Ships

Every civilian aircraft operating across national borders must have a callsign in accordance with the international callsign system. American civilian aircraft prominently display their callsign as a number beginning with the letter N near the tail of the aircraft, as in Photo A. Even hot air balloons and blimps are decorated with their callsigns according to this system. When watching a movie, you may occasionally discover an amusing situation in which movie producers that otherwise strive for realism often overlook the callsign. For example, you may be watching a movie that ostensibly takes place in the Rocky Mountains and observe that the rescue helicopter is marked with a Swiss callsign beginning with the letters HB. I have seen several of these revealing inconsistencies between the supposed location and the aircraft or helicopter callsign on the



Photo A. The radio call is found on or near the tail of an aircraft. The radio call of a U.S. registered aircraft begins with the letter N.

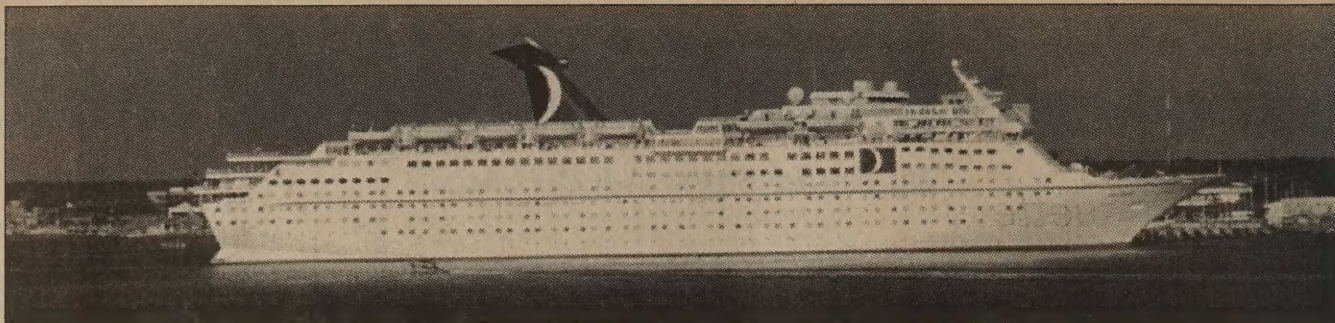


Photo B. A ship is usually not required to display its radio call on the ship's hull.

movie screen. Civilian vessels operating in international waters are also allocated callsigns according to this system. Many nations do not require these vessels to display their callsigns as prominently as they do the aircraft (see Photo B). Furthermore, commercial fishing vessels are required to display call-

signs by many nations that do not have this requirement for merchant ships.

All American broadcast radio stations formerly received four-letter callsigns. Today, however, broadcast radio stations may instead receive a combination of letters and numbers. A broadcast station that clearly

identifies itself simply by announcing its name or location may be in compliance with international requirements for radio station identification. Unlike the United States, many other nations therefore do not require that a broadcast station identify itself with its international call letters. **RF**

## Welcome Newcomers by Wayne Green W2NSD/1

**T**his is a sort of triple anniversary for me. When I started publishing 73 in 1960, 35 years ago this month, it never occurred to me when I was 38 years old that I might eventually be 73, which I am this month. And this month is also the 20th anniversary of my starting *Byte* magazine, which was another landmark in my life.

I got interested in amateur radio in my teens, first getting on the air in 1938. This interest catapulted me into a technical college (RPI), and then, when WWII got going, into the Navy as an electronics technician. The Navy electronics schools were fabulous.

I opted for submarine duty. Submarine duty was interesting and exciting at times. There were a few times when we thought we were goners. If you'd like to read more about that phase, I have available a 60-page report on Uncle Wayne's Submarine Adventures in WWII.

After the war I went back to finish college. By this time I was smart enough to realize that, though I enjoyed electronics, the likelihood of making much money as an engineer was small; so I changed my major from EE to Management Engineering. I passed up Westinghouse, General Electric, and all the other red carpets hung out for seniors. I'd worked at GE for a summer just before joining the Navy, so I knew that I never wanted to work for a large corporation. Jack Younts, who'd worked for my father while he was starting the first trans-Atlantic air-

line, and who was now running his own radio station in North Carolina, offered me an announcing job, so I packed my ham station in my car and drove to Southern Pines. When I got there Jack asked me if I had my First Class Commercial license. So I got on the train that night to Washington, DC, to get one. I was at the FCC headquarters when they opened the next morning and, within an hour, had passed all four elements of the test and had my license in hand.

I asked 'em to check and see what W4 calls were being issued by the amateur division. They responded, "They're giving out W4NSA right now." I said to issue me W4NSD, which they did. I took the train back to North Carolina with my First Phone and W4NSD tickets.

When I walked into the station that afternoon, the chief engineer jumped up, shook my hand, showed me where the on-off switch was for the kilowatt transmitter, and left. Permanently. I found out why later. Jack was not an easy person to work for.

Another friend of my father got me an engineering job with WPIX (channel 11) in New York, where I soon became chief cameraman. That was fun working with people like Gloria Swanson and Rube Goldberg. I also worked for awhile at a couple of radio stations: WSPB in Sarasota, FL, and WVEC in Hampton, VA; and as a TV director at KBTB in Dallas and WXEL in Cleveland.

Every inch of the way it was amateur radio that guided my life. It got

me my engineering background and into submarine duty, and influenced my work all through life. It's also brought me endless adventures.

So here I am at 73, when most men are retired and playing golf. My magazine, 73, is still perking along after 35 years. I feel some no doubt exaggerated satisfaction over the fast-growing cellular telephone industry because I know it sprung from the articles I published in 73 and from the push I gave to repeaters 25 years ago with my *Repeater Bulletin*, hundreds of articles in 73, the books on repeaters I published, and the conferences I organized around the country to bring standards to the field.

So what's next? Here I am 73, with high blood pressure, and likely to find myself in the next world at any moment. Meanwhile I'm going to do the best I can to make this world better. And that includes hectoring you to get off your butt and get busy. With your help we can make amateur radio more fun, and of such obvious value to the world that it will be recognized as an important resource.

I've had a bunch of close shaves when I thought, "Hoo, boy, this is it." Maybe you have to get to be 73 before you start to realize that hey, buddy, you really aren't going to live forever. Or maybe you *have* made good use of the time you have. If you've had some ham radio-oriented adventures, how about writing about them? Don't make me do all the writing. **RF**

# Don't be a "Lid"

*Etiquette and consideration make it easier for all.*

*by Bob Shrader W6BNB*

**T**he term "lid" in radio-operating jargon is an interesting historical word but has nothing to do with what you might put on top of a garbage can. A lid, as far as ham operating is concerned, is either an improperly trained newcomer or a veteran operator who may do things that make communicating with him or her either difficult or undesirable. Obviously, no one wants to be considered a lid by fellow amateurs.

In most cases, amateurs handle themselves quite well on the air. But there are some things that almost all radio amateurs might do to improve their communicating skills. When using a microphone with SSB or FM, you could probably do several things a little better. When operating CW, you may be doing many other things that indicate some degree of ineptness in radiotelegraph operating.

Let's consider operating on phone bands first. Some of the things that you should do to show that you are a good operator are:

## **Monitor Before You Start Transmitting**

There may be a QSO in operation on a frequency, but the station who is transmitting may be in your skip zone and be inaudible to you. The other stations communicating with that station may be quite audible to you when they come on. You would interfere with these stations listening to the unheard (to you) station if you were to transmit on this frequency at this time. After listening on an apparently clear frequency for a little while, you should ask, "Is this frequency in use?" If you receive no answer, you can assume that it is an unused frequency and you are free to use it.

## **Know Your Carrier Frequency**

When you are operating a transceiver on SSB and tune in a station so the voice quality sounds as normal as possible, your receiver and transmitter are probably tuned to

that station's frequency. But, if your rig has an RIT (receiver incremental tuning) control and it is not set to OFF, or tuned to zero, when you transmit you will be as far off the other station's frequency as your RIT control is offset. It is important that the RIT control be off or set to zero (different rigs have different RIT designations) when working SSB. If you use an antenna tuner, switching your rig to "Tune" usually produces a single tone modulation to provide a constant signal, so you can see your meter move up or down as you tune. Unfortunately this transmits the tune-up tone, which will interfere with listeners on the frequency. To prevent this you should move to some nearby free frequency and tune-up there, then return to the frequency of the other station(s). In most cases, if you tune your receiver to an SSB station's frequency and switch to "CW" mode, you will have your carrier frequency exactly on the SSB carrier frequency and you can tune at low power without causing any interference to other stations on that frequency. To anyone receiving the SSB station, you are only providing a carrier at the frequency of the suppressed carrier of the SSB transmitter and you will probably not be heard at all.

If you use a separate transmitter and receiver instead of a transceiver, turn your receiver RF gain way down after an SSB station is tuned in. Your SSB transmitter can now be turned on and tuned to an audible zero-beat (the audible whistle you hear from your receiver as you tune your transmitter from a high pitch tone down to a zero pitch). How you perform this depends on your antenna receive/transmit change-over switching system. Good operating procedure requires zero-beating as rapidly as possible to prevent interfering with other nearby stations listening on the frequency.

## **Use VOX If You Can**

VOX (voice operated transmit) means that your transmitter only

turns on when you speak into your microphone. You must talk close enough to your mike ( $\pm 2$  inches) so that room noises will not actuate your transmitter. Keep your mike gain down to the lowest level that allows your voice to adequately modulate your transmitter. If the gain is down properly, when you pause to catch a breath your receiver switches back into action and you can hear if there is anyone else on your frequency. Besides VOX, there is push-to-talk (PTT) operation. With PTT, as long as you hold the mike button down your transmitter stays on and you have no way of knowing if there is anyone else transmitting on your frequency. When you are operating amplitude or frequency modulations (AM or FM), VOX could be—but is normally not—used. PTT seems to be the desirable operating mode.

## **Be Careful Not to Tailgate**

Many operators, in their haste to say something or perhaps to answer a question, will start talking or transmitting before the other operator has ended his or her transmission. This overlap is known as "tailgating," which results in both stations being on at the same time, or in "doubling." Doubling is quite common with large net operations, particularly during pre-net operations. Good operating procedure is to use fast VOX and then always to wait until you can hear the transmitting station's background noise change before you start to transmit. Of course, if two stations wait the same amount of time and start transmitting at the same instant, VOX operation should inform at least one of the stations to stop transmitting.

## **Do Not Overmodulate**

When speaking into your microphone, you produce sideband signals at least 3 kHz out from the carrier frequency with SSB, or a bandwidth of 6 kHz for double-sideband AM and possibly even more for FM.

If you speak too loudly into the microphone, you may develop over-modulation and distorted signals. This can result in distortion products two or three times the bandwidth of a properly operated transmitter. Your modulation may also sound harsh and you may interfere with stations operating on frequencies that should be adequately removed from you.

### Tune Up on Clear Frequencies

Stations using antenna tuners or transmitters with stages that must be tuned to minimum plate current and minimum antenna SWR should learn how to tune-up in a minimal time. Move to a free frequency at least 4 kHz from the frequency of the group you want to join to do your tune-up. Always use minimum power during tune-ups. Transmitter frequencies can usually be moved 30 kHz or more without requiring retuning with any type of wire antenna. However, short, center-loaded whips on the lower frequency bands may have a working bandwidth of perhaps only 10 kHz.

### Interrupting a QSO

If you break into an on-going QSO, be careful that you do not take over and talk mostly with one or two of the stations in the QSO, leaving others out in the cold. This is always resented by the station or stations who are frozen out of the QSO.

### Sign Your Call Properly

You must transmit your callsign at least every 10 minutes during a QSO and when you sign out. It is desirable to include the callsign of other stations in a QSO when you sign out unless it is from a large net.

So much for working on radiotelephone. When you are using CW (radiotelegraph), it is much easier to get into trouble and sound like a lid. CW is like another language. Its rules are fairly difficult to learn and use properly. Consider the following about CW operating:

### Make the Spacing of Proper Duration

Letters and words are the basis of all of your CW communicating. Each letter must be a tied-together package all by itself; its dots and dashes must be made as one unit with minimal spacing between them. There must be longer spacing between letters than between the dots and dashes in letters, but all of the inter-letter spaces should be of equal duration. Work on trying to make the spacing between words at least

twice and maybe three times the inter-letter spacing or you may tend to run your words together. Running words or letters together makes it very hard for the other operator to understand what you are saying.

### Sending Speed

Don't send any faster than you can copy. Actually, few operators can send properly at speeds faster than they can receive, although they may think they can. Your sending speed tells the other operator at what speed he or she should send to you. If you normally handle code at a faster speed than that of the other operator, *sloow down*. There is no

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**"Using abbreviations for well known words is fine, but don't try to abbreviate too much."**

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sense sending any faster than the other op can copy and understand. If the other op sends too fast for you, or is not making good letters, or is spacing letters or words improperly, don't be afraid to use the QRS (send slower) signal. If the other op is a lid and won't slow down, this is a good time to say 73 and sign off. There is no sense in wasting your time sending or receiving information that is not being understood!

### Receiving Code

When you begin copying code, you normally do it with pencil, a typewriter, or maybe a computer. As soon as possible strive to remember two and then three letters before writing or typing them. This procedure is known as copying behind. With practice you will be able to hold several letters in your mind. Then you will begin to hold two or more words in memory. Finally, you will be able to just sit back and listen to what is being sent. You won't have to put anything down, a skill known as copying in your head. This is what all good CW operators do. When you learn to copy in your head, you will find that you will be able to copy a lot faster, too.

### Calling CQ

Before you call CQ, find a clear spot on the dial, one with no signals within at least 500 Hz on both sides. Make sure your transmitter is set to the center of this band of frequencies. If you are using a transceiver, the RIT control should be off or set at zero. If you are using a separate

receiver and transmitter, turn down the receiver RF, lower the power output of your transmitter, and tune your transmitter back and forth through the zero-beat you hear in the receiver. Stop at the louder of the two variable tones on each side of zero-beat. Select a tone of about  $\pm 700$  Hz. Turn up your power and send "QRL?", which means, "is this frequency in use?" If you hear "Yes," or "C" (meaning "si," the Spanish word for "yes"), or "QRL" (this frequency is in use), just send "R" (meaning "roger") and look for a new clear frequency. When you do tune up on a clear frequency, try sending CQ three times and signing twice. In a surprising number of cases you may get an answer to such a short CQ, particularly if you have spent any time tuning up on the frequency. If no answer is heard, call CQ three to five times, sign once, send CQs again, sign again, send CQs again, then sign twice and end with "K" (go ahead). Good operators do not send a long string of CQs without signing intermittently!

### Answering a CQ

If you hear a CQ, first copy the call sign, then zero-beat the received signal as rapidly as possible. At the end of the call, send the calling station's call once or twice and sign your call at least twice, making sure to send it clearly and properly spaced, ending with a "K." When answering DX stations, you may want to call off-frequency a little and repeat both calls more.

### Error signs

Inevitably you will make errors when you are sending CW. The following are rules for correcting errors:

(1) When an error is made, you should immediately send an error sign, either eight dots, or two question marks, or the symbol SN, and then repeat the whole word in which the error was made.

(2) If you make an error in the first letter of a word, make an error sign and go back and repeat the last properly sent word and continue on.

(3) If you leave too much space between letters in a word, or between dots and dashes in a letter, these are errors and should be treated as such. Good operators make it as easy as possible on the receiving operator when they send CW.

### Use a single frequency in QSOs

Always zero-beat the CW station you work. Most CW station operators do not know how to really zero-

beat their transmitter to a signal they hear. As a result most QSOs will use two different frequencies. Being off by 50 to perhaps 100 Hz is not too bad, but if two stations are off 200 to 500 Hz or more, the QSO takes up a lot more than its fair share of the band. With good modern receivers having bandwidths of 200 to 800 Hz, a separation of perhaps 400 Hz should be adequate for two different CW QSOs on a busy band. If you operate with a receiver having a bandwidth of 3 kHz or more (such as an SSB receiver), you must remember that when modern CW stations move to perhaps 500 Hz of your operating frequency, you are out of the passband of their receivers and they probably don't know you are there. They are operating properly within the limits of their modern equipment. The trouble here is that you need a narrower passband filter in the IF stages of your receiver to operate effectively on CW today.

#### Abbreviations

Using abbreviations for well-known words is fine, but don't try to abbreviate too much. It can become very confusing even to a good receiving op and can be devastating to those who are newcomers. This may be the reason why an op having trouble deciphering your abbreviations cuts short a QSO. Actually, abbreviating saves relatively little time.

#### Use break-in ("QSK") if possible

Many amateurs have a rig with a QSK capability, but they do not know how to use it. Operating "QSK" with the key up may produce a high receiver background noise. Turn the RF gain down to minimal noise and then try using QSK. The QSK control may be labeled "VOX ON" or have some similar designation. As soon as your key is opened, you immediately hear received signals. If the other station holds its key down while you are sending, you will hear its tone between your dots or dashes and you can stop sending to find out what the other station wants to say. "Semi-break-in" is almost useless, only allowing break-in between words and then only at slower code speeds.

There may be other procedures that could improve our operating on the ham bands. The important thing is not to sound like a lid and to make it as easy as possible for the person on the other end to understand what you are trying to tell him or her.

RF

## What you missed in 73

If you don't read the August issue of 73 *Amateur Radio Today*, here's some of what you're missing:

- Have the hottest packet signal on the air with your "Tube TNC: A Packet Breakthrough." WØXI takes you through a simple home-brew project.
- Is packet worth nearly freezing on a mountain? VE7PMR thought so in "VE7PMR Packet Solar-Powered Node." He and his friends braved the elements to set up a solar-powered repeater on a 6,400-foot mountain in British Columbia.
- Stuck with 1,200-baud packet radio? WB9UTK says you don't have to be. You can be sending and receiving "19,200-Baud Packet."
- Maybe you'd rather talk on SSB. You ought to know about "RF Speech Processing." VK3CA can show you how to get an extra 6 to 9 dB of talk power.
- You'd want your speech crisp and clear when you're "Working the Final Frontier" and talking with astronauts! Learn about AMSAT, Keplerians, and flying Venuses from N2CQR/H18.
- K4CHE gets us back to earth with his "Single-Chip Identifier." Need a compact fox box or beacon? Learn how to put together an economical timer and ID circuit for your repeater, balloon, or whatever.
- With all the new phones available, there's bound to be more complaints about RFI.

W5UOZ tells about the FCC's study of "Radios, Telephones, and the Amateur."

- But "Gordo" has no complaints about the "Icom Z1A Dual-Band HT!" In fact, WB6NOA thinks it's definitely different! Read about the HT with the detachable head and features galore: sensitive, selective, and surprisingly immune to intermod.
- Great things come in small packages, and KE8WO tells about one with the "Hewlett Packard 200LX Palmtop Computer." With a micro-HT, a tiny TNC, and the 200LX, you can have a packet station in three pockets!
- And that micro-HT may well be the Standard C508A that KB1UM fell in love with at Dayton. Read about the two AA-powered "Teeny Talkie!" It measures only 2-1/4 by 3-1/3 by 1 inch!

Read **73 Amateur Radio Today!** Order and save \$27 off the cover price. You'll receive a one-year subscription to the best ham magazine money can buy, for just \$19.97. Call 1 (800) 289-0388. **RF**

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# Which Microphone?

## Putting Your Best Voice Forward

by Dave Miller NZ9E

**W**e all use microphones, whether for FM, AM or SSB voice communications, but what considerations are most important in selecting the *best* microphone for the situation at hand? When choosing the best microphone for a particular radio, you will find that operator voice characteristics and pure operating ease are not always as obvious as it might seem. Most transceiver manufacturers make a *companion* mike for their radio, but it may not be the best choice for your own individual set-up. That's why they're often sold separately and why others make and sell *only* microphones.

Going way back to the beginning, microphones were made of carbon granular "piles," packaged into a case, with a voice-driven diaphragm attached to them. When the sound waves hit the diaphragm, the latter moved slightly, changing the resistance of the granulated carbon pile. This resistance change can be likened to a carbon potentiometer connected to a sound-sensing diaphragm, and the potentiometer being varied at a voice-audio-rate. *Carbon microphones*, as they were called, were around for a long time, first in amateur and commercial broadcasting, then in telephones for many years. Carbon mikes are simple, rugged, and will put out quite high audio signal levels. They don't have very good frequency response, however, and the "carbon-mike sound" is quite easy to identify when you're used to hearing something better. Carbon microphones have all but disappeared from modern equipment for this reason.

One of the most important considerations in microphone design is a very low mass diaphragm coupled to a very easily driven transducer element; the transducer is the portion of the microphone that converts sound waves into electrical variations. The lower the mass of the diaphragm, and the easier the transducer is moved (driven), the higher and smoother the frequency response of the microphone will generally be. A wide and smooth (flat) frequency response translates into

faithful reproduction, the goal of most good microphone design. In the search for better frequency response, early broadcasters experimented with what came to be known as the *condenser microphone*. It was composed of two plates, one very thin and flexible with high voltage on it that responded to sound waves, followed by a very high gain audio amplifier. That pretty much describes the early condenser microphones. They could be made to sound quite a bit better than the

carbon mikes that they were replacing, but the need for high voltage on the condenser mike's diaphragm element, and the very high gain, low-noise amplifier following it (right at the mike, by the way), made the practical everyday application of a condenser mike something that just didn't lend itself very well to the bulky and power-hungry tube technology of the day.

Broadcasters quickly turned to the *ribbon microphone* when it made its appearance. The ribbon mike consists of a *very thin* metallic ribbon element, suspended between the poles of a *very heavy* magnet. As the extremely thin ribbon is moved slightly by the sound waves hitting it (not too hard, or it would actually break!), a very tiny voltage is set up across the ribbon within this strong magnetic field. This very low impedance—because the ribbon is virtually a short, tiny voltage—can be transformed into more usable higher values with the proper audio transformer; thus, the ribbon microphone became very popular within the broadcasting and music-recording industries for good quality audio reproduction.

Ribbon mikes sounded good—and still do—but they're delicate, not to mention expensive! A mike was still needed for broadcast field work, public address systems, and of course amateur radio that was better sounding than the older carbon mikes, but yet not as fragile and expensive as ribbon microphones. The moving coil, or *dynamic microphone*, was one answer. Very much like a speaker in reverse, a dynamic mike is a coil of wire attached to a diaphragm and moving—with sound pressure—within a small confined magnetic field. It can be made to be quite compact and rugged, and is relatively inexpensive. The dynamic mike became pretty much the standard for broadcast field pick-ups, PA and, of course, amateur radio work. Dynamic mikes, however, like the speakers that they mimic, can vary quite a bit in their sound quality, frequency response, smoothness of sound reproduction, and so forth.

Two other microphone types have



Photo A. RCA 77D ribbon microphone used by radio and television broadcasters during the 1950s. Announcers loved ribbon mikes because of the low frequency emphasis when "close talked," but the ribbon is very delicate and easily damaged. The 77D can still be seen occasionally as a prop on the desk of variety show hosts like David Letterman.



Photo B. Slim-line Japanese Dynamic broadcast microphone uses a dynamic moving coil element and can be hand held or desk-stand-mounted as shown in the photo. Dynamic microphones are quite rugged while boosting reasonably smooth frequency response characteristics.

been used in ham shacks over the years and should also be mentioned: the crystal mike and its ceramic counterpart. The crystal microphone was made of crystalline salts in a very compact package, but was sensitive to temperature and humidity extremes. It's been used over the years in the ham environment, but isn't generally known for ruggedness nor particularly long life. The ceramic element answered some of the problems of the crystal microphone, but has never seen as much popularity as the dynamic microphone element for general ham radio use. It's inherently a high impedance mike element, but more on that later.

With the advent of reliable solid-state electronics and linear integrated circuitry for wideband audio amplifier packages, the old condenser microphone idea was reborn. Remember the drawbacks of the early condenser microphone idea, high voltage on the moving capacitor plate and a high-gain, low-noise amplifier following? Advances in solid-state design, plus the practical perfection of the electret permanently charged condenser diaphragm, made the old condenser mike dream a reality. The electret element was a major innovation in microphone design. A tiny conductive Mylar diaphragm could be given a permanent electrostatic charge, making the sound-actuated variable condenser a workable concept. That, added to a tiny high-impedance FET amplifier—or preamp—enabled microphone designers to produce a mike that was extremely small, yet possessed the quality characteristics of the con-

denser microphone of old. Truly a dream come true.

The electret condenser element does require a small voltage—often as little as 1.5 VDC—to power its built-in FET-based preamp; but for that effort, it will provide a very nice-sounding audio output reproduction curve. The tiny “tie-clip” mikes that you see on TV newscasters and talk-show host & guests are based upon electret mike elements. They're often fed into high-quality, amplitude-compandored FM belt-pack transmitters and then received on RF diversity amplitude-expanded receivers for transmission into the studio's audio board, giving wireless mike freedom to the on-the-air talent. The electret condenser microphone and the high-quality wireless RF system have virtually taken over the television production industry. That same electret condenser element technology is being widely used in our ham radio microphones of late.

Perhaps it's time for a summary. Practical modern microphone elements include the moving coil dynamic element, the ceramic microphone cartridge, and the tiny electret condenser mike package.

What is all of this leading to, and why should we even be particularly concerned about it? All you really have to do is to buy the manufacturer's recommended microphone for each rig? Well, aside from the cost standpoint, what if you would like to

have just one microphone, or perhaps two at most, that would cover all of your transceivers, instead of a desk full of *special* dedicated mikes for each radio? Which one is best?

Generally speaking, the electret condenser package is a tough one to beat for size, flat wide-range audio response, and physical ruggedness. But there are other considerations. If you don't have a *clean* (that is, no digital spikes, RF noise, or hum) low-voltage, low-current power source at each of your transceiver's mike connector pins, then perhaps a microphone that doesn't require external power may be the best choice. Batteries can also be used to power an electret mike and preamp, but batteries do have to be replaced from time to time. That may leave you with the decision of a dynamic versus a ceramic mike element if you're looking for a stand-alone microphone. Dynamic elements generally have less audio output for a given sound pressure input than do ceramic elements. That might be an important factor in your particular setup. Dynamic elements, however, will also usually take more abuse, and can often be made physically smaller than their ceramic counterparts. So it's not always an easy, cut-and-dried decision. I've tried a fair number of various microphones on my own transceivers—HF, VHF, and UHF—and I've not yet found what I would consider to be the “universal” answer. Electret ele-

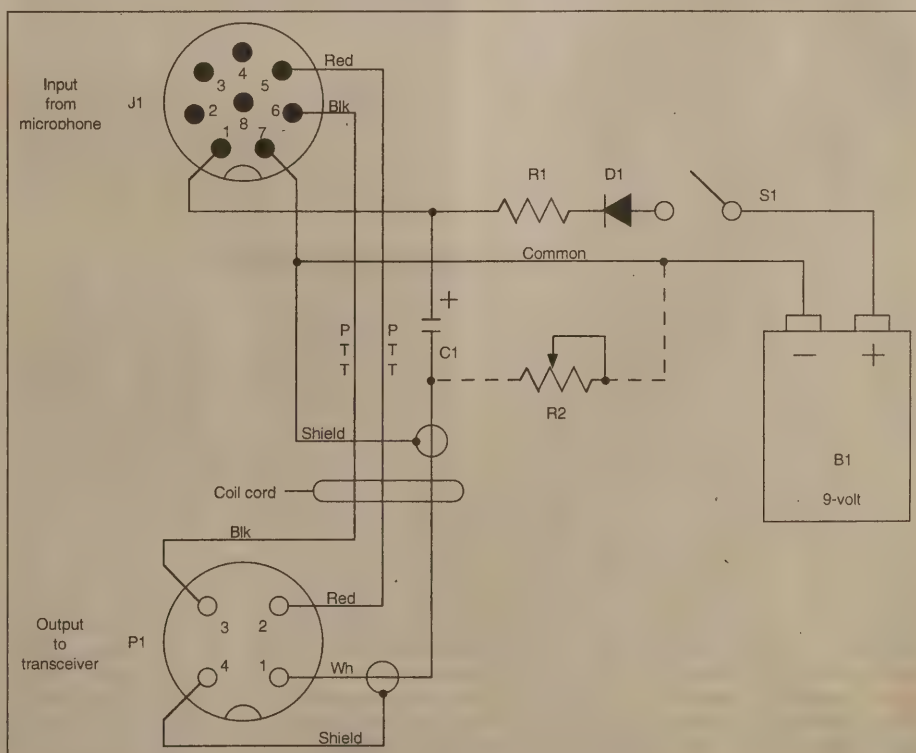


Figure 1. Schematic diagram

ments all sound much the same: quite good. But within the realm of dynamic and ceramic mike cartridges, fairly large variations can and do exist. The only way that I've ever really been able to judge how my transceiver will sound when using a particular dynamic or ceramic mike is to *actually try it*.

The best way I've found to do that is to listen to my signal on a pair of good quality headphones connected to a second receiver, with my station's transmitter terminated into a well-shielded 52-ohm dummy load. Under this condition, you should be able to find some compromise setting between your receiver's RF gain control and the volume control that will allow you to listen to yourself without overload distortion coloring the results. Using this method, I've found that different microphones can make a tremendous difference in the overall sound quality—as well as in the degree of intelligibility—of *my* transmitter with *my own* particular voice characteristics. I was surprised at the differences that I found when I first tried this a number of years ago, but after thinking more about it, I believe it does make sense from a technical standpoint.

There are three parameters that basically determine a microphone's ability to faithfully replicate the speaker's voice into a *particular transceiver*: the microphone's *output impedance*, its *output level*, and its *frequency response curve*. All three should be matched as closely as possible to your transceiver. You can generally find out what the first two are—the required level and impedance—by looking in the trans-

### Parts List

B1	standard 9-volt alkaline battery RS#23-553
C1	2.2ufd, 35V tantalum capacitor RS#272-1435
D1	1N4001 silicon diode RS#276-1101
J1	8-pin transceiver mike panel jack (available from many ham equipment dealers, or often from hamfest flea market vendors)
P1	4-pin transceiver mike connector RS#274-001
R1	4.7K, 1/4-watt resistor RS #271-1330 (often, any resistor from 1K to 5.6K can be used for R1, but the lower values will simply draw more battery current with no additional benefit)
R2	1K micro-size trimmer pot RS #271-280 (optional gain control)
S1	SPST miniature toggle switch RS #274-634
	9V battery holder RS #270-326
	9V battery snap connector RS #270-325
	Coiled mike output cable RS #278-356
	Enclosure RS #270-230 or equivalent

ceiver's owner/operator manual, but if they're not detailed there, then don't shy away from writing to the manufacturer for these figures. Simply explain why they're important to you and you'll probably receive a positive response to your inquiry. The third one, the frequency response curve of the microphone versus the frequency response curve of the transceiver, is a bit more difficult. A practical test into a dummy load will tell you more about this than all of the written material that you could probably gather in a lifetime.

Most of today's solid-state transceivers very often work well with any low-impedance mike, something around 600 ohms. That wasn't always true in the past, since most ham transmitters were designed for medium to high impedance microphones: 50K to 1 meg ohm impedances. Ceramic mikes, as stated previously, are generally considered high impedance, but quite often will work with even a relatively low transceiver impedance input. Correct microphone input impedance matching has more to do with opti-

mum voltage transfer than it does with optimum frequency response from a practical standpoint, especially within the limited audio frequency band that hams are concerned about—300 to 3,000 Hz—but it's still worthwhile considering.

A microphone's output level can be very low: -80 DBM for ribbon mikes all the way up to -22 DBM or more for typical carbon mike elements. The correct input impedance will pretty much guarantee maximum transfer of energy as previously mentioned. How

much a transceiver's mike audio input stages can provide in the way of internal amplification are part of the formula, as are hum and noise pick-up that can sometimes be associated with running too much mike audio gain within the rig itself. An external preamp right in the mike base is often a partial answer, but sometimes RFI—your own transmitter's RF feeding back into the mike preamp—can negate an external preamp's use as the best decision.

The relative match of a microphone's frequency response to both the audio stages within your radio, and the particular characteristic's of your own unique voice, play a large part in how well you're heard at the other end of a rough DX QSO, as well as how easy it is to listen to your station's signal over a long local rag-chew.

These are the reasons that you *really do* have to listen to your own signal in real time, while trying different microphones, to see which sounds best to your ear. It will also usually sound best to everyone else's as well!

RF

### Using An Electret Mike with An Older Transceiver

Most of the modern desk-type and hand-held microphones produced for ham equipment today are of the electret-condenser variety—with built-in preamps—and as such, require that external power be derived from the transceiver with which they're being used. Many of the older amateur transceivers, however, have no provision for supplying power from their microphone input connectors, particularly if the connector is of the four-pin variety, making them effectively incompatible with these newer microphones.

The circuit shown in Figure 1 solves the microphone power problem in a neat, easily constructed package.

The wiring shown in the schematic diagram is intended for an Icom IC-SM5 microphone to be used with a Kenwood four-pin transceiver, but may be varied to suit the particular microphone that you happen to be using, as well as the transceiver that you would like to use it in conjunction with.

Referring to the eight-pin connector in the schematic diagram, pin-1 is the high mike-audio-lead, which also receives DC voltage for powering the mike preamp, and provides polarizing voltage for the electret element itself. Pin-7 is the mike low or common—which may or may not be at chassis ground potential—so it's kept above ground at this point. Pins 5 and 6 are the Push-To-Talk wires. Refer to the instruction sheet for your specific microphone's output wiring and to the owner's manual for your transceiver's microphone input wiring, just in case it happens to be different with your particular brand of equipment. The remainder

of the circuit should be readily usable, however.

Power for the mike and its preamp is supplied by a standard alkaline 9-volt battery, via a 1N4001 diode—so that incorrect polarity cannot be applied to the mike even momentarily—and a 4.7K isolation resistor, which keeps the low impedance of the battery from loading down the audio line. The 2.2ufd capacitor couples the audio into the mike connector of the transceiver, while blocking any outside DC voltage from entering the transceiver's circuitry. R2 is an optional gain control just in case the audio output from your mike and preamp is too high for your transceiver's microphone input. It can be adjusted to provide a "comfortable" audio level between the microphone and the transceiver. The IC-SM5 draws about 1 1/4 mA when powered by a 9-volt battery, so switch S1 is provided to disconnect the battery from the circuit during non-use.

This same set-up can also come in handy for testing a microphone that might be acting up, by simply feeding the output (pins 1 and 4 on the four-pin output connector) to the microphone input of any audio amplifier, and then listening to the microphone's signal. You can easily check for extraneous noises and breakup—off the air—using that setup.

All of the parts (with the exception of the eight-pin male mike connector) are available from Radio Shack and may be housed in a small enclosure for protection and a clean, "finished" look. A complete parts list is shown along with the schematic diagram.

# Introducing Packet

## *An Alternative Approach.*

*by Andy Loomis KEØUL*

**P**acket radio is perhaps the most awkward, complicated, and slowest method of carrying on a conversation ever invented for amateur radio! Yet we hear others speak of packet as the greatest thing to hit the hobby since the advent of FM repeaters. It seems that almost everyone who has ever managed to get a packet signal on the air is excited about it; some get so enthusiastic about it that they seem to forget that other modes still exist. What gives? If you can't enjoy a conversation using packet radio, what's all the fuss about?

### **Messaging**

The attraction is an old concept called messaging. Packet radio offers us a means to send a message, as short or as long as we wish, to any ham operator in the world, completely error-free, with no more power or effort than it takes for a local, 2 meter contact. This was the dream of Hiram Percy Maxim himself: to set up a network of relay stations, coast to coast, in order to pass a message from point A to point B in the shortest possible time. To this end, he and others with similar interests created the American Radio Relay League, whose original purpose was to establish such a network. Did it ever work? Sometimes. It was crude, it was subject to propagation quirks, and it depended on hams actively attending their stations to "pound the brass" and get the job done. Of course, the ARRL quickly spread its interests far beyond the bounds of relaying traffic, so the National Traffic System was born in an attempt to keep the system alive to this day.

Now, enter packet radio. As you read this there exists a worldwide network of automatic, unattended relay stations—operating 24-hours a day—ready for you to use for only the cost of your own equipment. The network is so vast, so complete, and so effective that you only need to

make a single contact with a local, 2 meter station to send any message, any length, anywhere! Your message is guaranteed to arrive at its destination exactly as you typed it. Maxim's dream is finally a reality: Packet radio has revolutionized the messaging aspects of amateur radio forever.

### **The Packet Advantage**

Here are just a few examples of what you can do on packet that simply cannot be done using any traditional ham radio mode:

1. You can send a bulletin, readable by every ham in the United States, announcing the old HT you have for sale. Or you can list a roomful of stuff you're willing to donate to a good cause.

2. You can look up any number of names and addresses from somebody's CD-ROM callbook in West Virginia without disturbing its owner.

3. You can receive detailed, scientific data on every earthquake in the world for the past dozen days, or get a list of the orbital elements of every interesting satellite circling the globe.

4. You can send some intricate mathematical formulas to your friend in Scotland, without worrying about an "x" changing to a "y."

5. You can post a bulletin in every town in Germany asking for advice on how to repair your old Grundig short-wave receiver.

But packet radio can never replace chitchat. It's not supposed to. Ham radio has always been a social hobby, full of conversations about every topic under the sun. Packet is simply not suitable for this type of activity. It can be done, of course, and often is; but you should learn this now: Packet's indisputable strength is pushing paperwork. You may be quite disappointed with packet radio if your intent is to use it as just another conversational mode.

When you first got your license and tried to use a repeater, you had to learn quite a few operating techniques. You needed to learn about offsets, hang-time, and courtesy beeps. You also had to learn how to operate your radio, how to put "PL" in it, and how to make an autopatch call. Packet is no different. There will be a few new things to learn, but no more than what you have already demonstrated you have a capacity for. The secret is to set aside everything you know about normal ham operation!

Open your mind to some completely different approaches. Forget offsets, PL, and PTT buttons. Forget beams, high power, rag-chewing, and QRM. Forget station identification, Q-signals, propagation, and signal reports. Packet is none of these. Your HT is exactly as effective on packet as your friend's kilowatt. Your 19" mag-mount antenna perched on the refrigerator is every bit as good as your friend's stacked, 30-element array. If you can hit *any* packet station with a 2 meter FM, full-quieting signal, you can reach the world.

Because of the already existing network in place worldwide, it is just as easy to send a message to Australia as it is to send it across town. The network itself "knows" how to route your message. Simply send it to the nearest full-service bulletin-board station in your community. From there, your message will hop through perhaps dozens of similar stations, all automatically, until it finally appears on the bulletin-board station in your friend's home town. There, at her convenience, she can pick it up on her own packet station. Generally, the forwarding process takes about an hour for statewide, about a day for North and Central America, and two or three days for worldwide messaging. These figures are average to worst case. Some messages get through in minutes, whereas others take a bit

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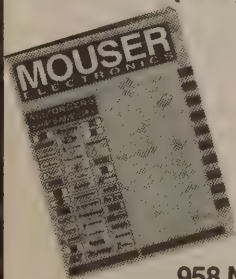
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longer. Packet radio is not fast. True, it uses high-speed data transmission with some fairly complicated, computerized equipment; but the end-to-end equivalent speed belies its sophistication.

The beauty of the system, however, is the lack of errors. Because packet is error free, it makes no difference at all how many "hops" the messages take to reach their destination. At each hop, the message may be placed on "hold" for a few minutes while other traffic is exchanged; then it is sent on its way. For this reason, it takes some time for a message to move through the network.

How packet does all this is beyond the scope of this article, the purpose of which is to explain just what packet has to offer you. There are numerous books that explain the technical aspects of packet radio, but you don't have to learn all the details in order to use packet, any more than you had to learn about oscillators and phase-lock loops in order to use your HT. By far, the most useful thing you can do in order to get the fullest benefit from packet is to become "computer literate." Learn how to operate a computer (as opposed to learning how a computer operates). Take a course at your community college or just learn by doing (playing).

### The Necessary Equipment

Assuming you already own a working 2 meter, FM radio, you will have to get a terminal node controller (called a TNC) and either a computer or a "dumb" terminal. The TNC will cost in the neighborhood of \$130, new.

Finding a used TNC is just about impossible because no one wants to sell them once they start using them. The TNC is the device that cross-translates computer language into packet radio language. But you can think of the TNC as a "black-box." You really don't need to know anything about how it works or why it works. But if you're like most hams, curiosity will someday win out and you will learn all about them. The TNC connects your computer/terminal and your radio.

By far the most popular TNC is the PK Series made by AEA. Other excellent brands are the Kantronics and the MFJ. There are even some "software" TNCs that make use of the computer's own internal intelligence to perform the necessary functions, but they generally require a much more extensive understanding of computers than most packet

beginners are willing to learn. Probably the best advice is to use the brand most popular in your area so you can draw on someone's help in the event you have a problem.

A computer or terminal suitable for packet can cost anywhere from \$20 to \$2,000. If you use a terminal instead of a computer, you will not be able to "save" any messages or precompose and edit your own outgoing messages. This can be an annoyance but it sure beats not being on packet at all! Terminals are cheap nowadays. It's hard to find a new one anywhere at a decent price, but the older ones are just fine. Plan to spend from \$20 to \$50 for a used terminal at any swapfest. Once you are enjoying packet, you won't be content to use the terminal forever and will probably end up with a real computer to run things.

All TNCs will work with all popular computers. Usually you will have to make or buy a special cable to attach your computer or terminal to your TNC. The TNC comes with full instructions for making the cable as well as for making a second cable that attaches the TNC to your radio. The next step is to follow the TNC manufacturer's instructions. Read the manual carefully and do exactly what is asked for. You will soon be "teaching" your TNC such things as your callsign and the callsigns of your favorite bulletin-board stations. You will teach your computer how to "talk" to the TNC. Once you've done this, the TNC knows everything else. It knows how to make and maintain your connection to the network. It knows when to transmit, when to listen, and when to ID itself. It does everything for you except decide who you are going to send a message to and which messages you want to read. You just sit at the keyboard, type a few strokes, and watch the screen!

Many packet operators leave their TNC and radio operating around the clock. All TNCs contain a mini-bulletin board for sending and receiving messages from the nearby hams. The computer is only necessary during the actual times you are typing or reading a message; it can be used for any other purpose when you aren't using it for packet. The TNC, by itself, sends, receives, and stores messages even while your computer is turned off! Keep this feature in mind as you consider the overall cost of your packet system.

I really hope this article helps shed some light on what packet radio is all about. I would be most grateful for any feedback you care to give.

RF

# The FCC Rules, Then and Now

*Think the rules today are too rigid?*

*by Dave Miller NZ9E*

**T**he rules and regulations governing amateur radio operation are *not* written in stone. They've changed quite a bit over the years, and probably mostly for the better. If you're relatively new to ham radio and perhaps thought that the rules today are too rigid, maybe a trip down memory lane to the "Good Ol' Days" would be an interesting journey for us all, veteran and novice alike.

We won't be going all the way back to the beginnings of amateur radio, because in the beginning there actually were no rules! To be totally honest, I don't go back nearly that far myself—only to the mid-50s, when I was first bitten by the ham radio bug; so we'll leave the *really* early times in ham radio to someone who knows more about that era from personal experience. Nonetheless, the changes that have occurred in just the last 40 years in our rules and regulations are interesting to note, and there have been many!

## License Classes

Back when I started there were six classes of amateur license. At the bottom of the ladder was the Novice Class license. The testing materials for the Novice license were available by *mail only*, and administered by another ham of General Class or higher, or by an individual holding a commercial radiotelegraph license. The Novice license was valid for one year only and was *non-renewable*. It was a once-in-a-lifetime ticket. It had a 5-wpm code requirement, and at the end of those 12 months the licensee was expected to have spent enough time on CW to be able to qualify for the General Class license; no exceptions! Novices were granted limited privileges on 80, 40 and 15 meter CW, plus CW and voice privileges in the upper 3 MHz of the 2 meter band—145 to 147 MHz. Novices were limited to 75 watts of input power and transmitters had to be crystal controlled. The Novice exam had its own less technically involved written element and no credit was received toward any higher grade license because it was taken

by mail. A Novice was issued a call-sign with "N" after the prefix, and the "N" would be dropped when he or she successfully qualified for higher-class privileges. Pretty rigid by today's standards!

Next came the Technician license. The Tech was also applied for by mail, taken under the direct supervision of a General Class or higher, or a commercial radiotelegraph license holder. It had a 5-wpm code requirement, and carried the same written exam as that of the General Class applicant, though originally credit was not given toward the General written test because, again, it was done by mail. Jokes abounded about the "mail-order, box-top Novices and Techs," implying sub-standard status by not having to face the "steely-eyed" FCC examiner in person. There's always been bias of one sort or another in most human activities, I suppose. In fact, the Tech license was mainly aimed at those who were interested in exploring and pioneering the VHF and UHF portions of the spectrum, since Techs were limited to 50 MHz and above. It was also aimed at the radio control model enthusiasts of the day. Later on, Techs were grandfathered Novice privileges when it was felt that many were being held back from upgrading to General because Techs had no HF CW privileges.

The Tech license had no power or crystal-control-only restrictions like the Novice license had, but the biggie was that it could be renewed every five years. By the way, when renewing a ham license at that time, you had to state that you were actively on the air at least two hours during the last three months, or five hours during the last 12 months of the time before application. You also had to affirm that you could send and receive CW at the rate of speed needed originally to qualify for your license class.

The General Class was considered the standard amateur license class and was formerly known as a "Class B" license. It carried a 13-wpm code exam, plus a fairly comprehensive written test—even with schematic

drawings of workable circuits drawn from scratch—covering the kinds of situations and circuitry considerations that the average ham might run into in those days of tubes and *much* homemade equipment. Most hams didn't go out and buy new transceivers in those times; they had separate receivers and transmitters, often home-brewed, and they were expected to understand the circuitry operationally, attest to their proper on-air quality, and be able to fix them when required. Things have changed a bit, haven't they?

There was also a Conditional Class license in those times. Since the General Class and higher exams had to be taken in front of an FCC examiner, and not everyone in every part of the country could make the trek to an FCC field office to take the exam, hardship cases were granted what was then called the Conditional Class license. It applied to those with disabilities, those who lived over 175 airline miles from an FCC office, individuals in the military service, and residents living outside of the country. The Conditional exam could be administered by a General or higher class licensee, a commercial radiotelegraph license holder, or the operator of a manually operated radiotelegraph station in the service of the US government. Conditional Class licenses were originally required to be retested at an FCC field office if they eventually moved to within the 175-mile radius of an office, but that was later dropped and the Conditional license could be renewed indefinitely regardless of where the licensee lived. Again, no credit was accrued for a higher class of amateur license because of the mail examination basis.

The Advanced Class amateur license was originally called a "Class A" license. At one point it was no longer available to new applicants, but those holding an Advanced license could renew it as long as they continued to meet the previous re-

*Continued on page 29*

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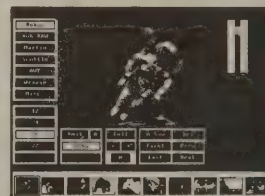
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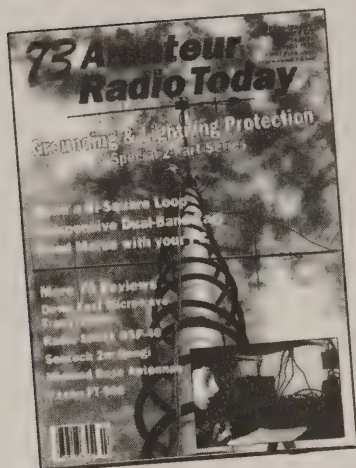
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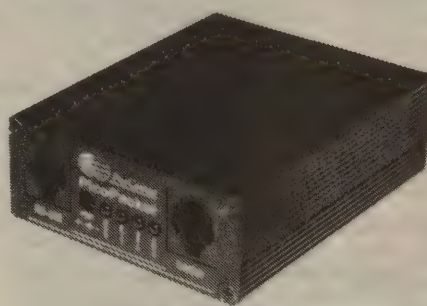
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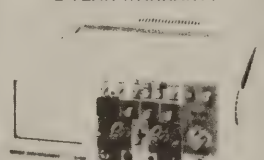
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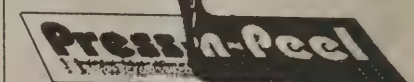
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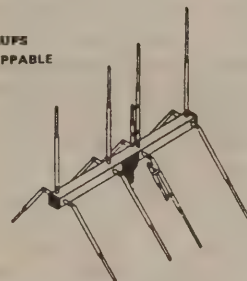
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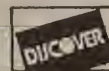
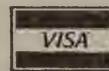
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## Packet for Non-Packeteers

### *A User's Report on the BayPac BP-1 Packet Modem.*

**A**s a rule, I was always a "real-time" type of Ham. I listened to many years of talks on packet and was present at many demonstrations. At Field Day, our club, the Bergen Amateur Radio Association in northern New Jersey, has had Packet setups and I have glanced at the CRT (or LCD with laptops) with those odd commands and other data on them. It always seemed so impersonal and out of touch. I could never understand the connection between amateur radio QSOs and packet. It didn't seem to fit in, as RTTY, CW, AM, FM, and SSB are all "real-time" modes. Moreover, the excuse of being DOS illiterate didn't fit because I have been a computer user since the VIC-20 era. I have heard others getting nervous because the word "computer" was used in the same sentence as "ham radio." However, computers have given amateur radio another avenue for expansion. I have been using satellite tracking programs for many years along with WEFAX, RTTY, CW, and so forth. My ham equipment and my computer certainly get used equally.

One of my co-workers became a ham recently and picked up a TNC and was telling me about "packet." I also have a few "B.A.R.A. buddies" that are into packet and have been caught on several simplex frequencies on FM asking each other, "Did you get that?" So with packet on my mind . . . off to Dayton. This year I was supposed to meet an Army buddy of mine at Dayton. At the last minute he had to cancel (always next year), but I went anyway with my wife Ginny N2EYN and two of my harmonics (15- and 16-year-old young ladies and non-hams), promising them a fun time driving to "Dayton." While strolling around those bargains (mostly alone as my YF was recuperating from a broken ankle), I came across a TNC that was "cheap" and was told it could do most anything a regular TNC could accomplish; at least it would get me on the air with packet. So after the required bartering, I parted with my money (under \$50) and went home with the

bargain. (What else was there to do when it's raining?) The BayPac BP-1 unit, a packet TNC, was now owned by a non-packeteer.

Upon arriving home, I started to put together the "8088" I had promised myself I would use strictly for packet and leave my 386 for the "other stuff." After setting it up with an RS-232 port, I added the BayPac unit to the Com 1 port following the instructions provided (three sheets) and proceeded to load the self-extracting software supplied with the unit. The software was "BayCom" and came complete with on-line help and files you can print out to have handy for reference on the program's use. Have plenty of paper; it's 60 pages! The instructions provided with the BayPac unit are easy to understand and even give a number you can call (at certain times) to resolve any problems you might run into with the installation that were not software related.

I experienced a shock as I realized I didn't have an extra mike plug for my dual bander and paid \$10 at a local electronics place for one to get me on the air. It might be a good idea to search at the local hamfests for a matching plug for your rig to keep on hand if you plan to get into packet. I connected the wire (telco type) to the supplied cable and hooked it to my dual bander. Both transmit audio and receive audio are needed at the mike plug; however, you could use an external receive audio output. My rig has an external speaker jack and I am using an audio pad to keep the volume down so I can concentrate on other things in the shack while packet is happening. Now, since I am not packet oriented, I had to reach for the repeater directory to find out what frequencies are being used for packet. I found a local DX BBS and dialed it up. I set the volume on the rig and up popped packet information on the screen. Then I had to check to make sure I was modulating the rig correctly and set up the "neatly hidden" gain adjustment on the BayPac unit using my Icom R7000 to check

the level (with dummy load, of course).

Now once again, I had to read the instructions (the printed ones from the software) to gain enough information to enable me to log onto "something"! I proceeded to log onto—oops, pardon me—"connect" to the DX BBS, and then was informed I couldn't use all the functions until I was formally acknowledged by the operator of the BBS. However, my unit worked and I had connected. I was a "packeteer." I dressed my cables and made it a permanent installation.

Since then, I have found out what frequencies my friends hang out on and several other bulletin boards to survey. Leaving high-speed communications behind (example: human speech), browsing through a host of for-sale items and "wanted" inquiries has been fun. Getting bulletins from the League and other organizations is useful and AMSAT information abounds. The BBS on the frequency on which I am camped is very busy and just getting a directory can take several minutes. Even in the "Talk" mode one has to wait for those DX clusters to go by. Just be patient.

The BayPac unit is manufactured by Tigertronics, 400 Daily Lane, P.O. Box 5210, Grant Pass, OR 97527; and the software, Baycom, is produced by German amateurs DL8MBT and DG3RBU, both of whom can be reached through Johannes Kneip, Tassiloweg 3, D-8400, Regensburg, Germany. Version 1.4 comes with the package. The BayPac unit is the size of a Centronics gender changer and the software came on a 3.5" disk (720K). The size has nothing to do with its performance, however. It does just about everything more expensive units can do with the exception of a mailbox, since there is no memory. I can report that if you have an IBM-compatible computer with an available Com port, you can easily get into packet communications with this package. Especially if you just want to try the mode, the price should not deter you from getting your feet wet. Remember, I was a skeptic, so you try it, too! **RF**



# Upgrade . . . Don't Stop Now

by Gordon West WB6NOA

## Packet Positioning

Amateur radio packet communications is an open gateway to the proverbial information highway. Not only can you receive tremendous information on packet, you could even get and give out information like an answer to . . . where am I?

"Who would ever think that GPS could be a reality for amateur radio packet users?" comments Jim Carter WB6HAG, who recently ran very successful tests of the AEA PK-12 system for transmitting and receiving GPS information via packet.

Packet positioning in the amateur radio service became reality with Bob Bruninga WB4APR and his automatic packet reporting system (APRS). It's possible to use the APRS software with your personal computer, tied into a GPS receiver, for both transmitting as well as receiving positioning information over the airwaves.

The APRS software makes it possible to connect a GPS receiver output to a computer serial port in combination with a standard packet terminal node controller (see Photo A). This software interprets the GPS datastream that comes out of inexpensive marine GPS hand-held or fixed-mount sets. The typical cost for a new marine GPS with "NMEA 0183" datastream output is less than \$300!

The APRS software interprets the

GPS NMEA datastream and places a predetermined symbol on a map showing your location displayed on your PC monitor. This symbol is determined by the dash number (SSID) following your callsign.

The APRS software is shareware, but it can be obtained directly from Bob for \$9 for the latest version or down-loaded free of charge from many BBSs. Despite its being shareware, Bob appreciates receiving the \$9 registration fee. When registered, the user saves the setup time when executing the program.

There are many cities, states, and local street maps to select from the APRS software (see Photo B). Many APRS users have drawn maps and submitted them to Bob for use. These maps may not be extremely precise, but they do provide an approximate idea of your whereabouts. The latest software version cost is \$9, registration is \$19, and GPS validation is an additional \$9. Please remit to Bob Bruninga, WB4APR, 115 Old Farm Court, Glen Burne, MD 21068.

The APRS software is interfaced with a professional mapping program called "Streets on a Disk" by Klynas Engineering (805-583-1133). It displays your location right down to the street or alley!

The mapping software is ideal for ARES or RACES organizations for

tracking their communicators during an event. It could also be used for boaters reporting in with weather net information.

Manufacturers of terminal node controllers are just beginning to announce their latest editions of GPS-ready systems. PACCOM was the first manufacturer to come up with GPS firmware that allowed a GPS NMEA marine signal to be connected directly to the TNC. The TNC has both TTL and RS-232 input ports that allow any GPS receiver output to be interfaced with it.

With the PACCOM, the GPS receiver signal connects to pin 5 for the TTL connector, or pin 3 for the RS-232 connector. The ground from the receiver connects to pin 3 on the TTL connector of pin 5 for the RS-232 connector. The PACCOM works well!

The latest product is from TNC specialists AEA (800/432-8873). The AEA TNC is smaller than the PACCOM, can be powered by an external 9-volt battery, and allows two different NMEA 0183 messages to be selected. If you already own a PK-12, AEA offers a firmware update for only \$10. The PK-12 instruction manual adequately covers how to connect your GPS receiver to the TNC when used with the optional APRS adapter cable from AEA.

*Continued on page 23*



Photo A. Portable GPS equipment will also work with packet position systems.



Photo B. The GPS shows maps, plus your position is transmitted over 2 meter packet radio.



# The Tech Side

by Michael Jay Geier KBIUM

## The End of Buttons

For the past several months, we've been exploring all the features on today's microprocessor-controlled, amateur hand-held transceivers. Let's wrap that up so we can move on to something else next time.

## The Fancy Stuff

So far, we've covered the VFO, memory channels, scanning, and CTCSS tones. What more can you possibly do with a walkie? Believe it or not, plenty more! All the operations we've discussed are enough to get you into a repeater and let you talk with other hams. But, in an effort to out-do each other, HT manufacturers have been adding features as fast as they can, regardless of whether we really have a use for them. Some of them are downright frivolous, whereas others can be handy now and then. Let's look at some of the more interesting ones.

## Phone Home

Walkies have had DTMF (dual-tone multi-frequency) pads for years. These are just like the ones on your telephone, and they let you make "autopatch" (automatic connection to the phone lines) calls on some repeaters, right from your HT! (They also let you control the operating functions of many repeaters, as long as you are the repeater's control operator.) There are lots of legal restrictions on autopatch use; this ain't no cellular phone. Still, autopatch can be a very useful thing, whether you need to call your spouse, a friend, or the police for help on the road.

Until a few years ago, you had to enter manually the numbers on the radio's keypad to engage the autopatch and then continue entering numbers for the phone number you were calling. That could add up to 10 or more numbers, making use of the autopatch cumbersome, especially while driving. Imagine trying to control a stick-shift car while

holding the transmit button with one hand and pressing the keypad buttons with the other! Even if you started out calling your friend for directions, you might wind up having to call the police instead to come rescue you after the accident you just had, thanks to your having to pay so much attention to the radio instead of the road.

The solution is the modern autodialer, a now-common feature on new HTs. It works just like any memory phone: You enter numbers into memories, in advance, and then simply recall them when you need them. In practice, though, it can get messy, depending on the HT's software design. Some rigs are fairly easy to store numbers in, while others require arcane keypress sequences. Because you don't enter numbers very often, though, that part really doesn't matter very much. The real test is in what it takes to send numbers after you've programmed them. After all, it's when you're keeping your eyes on the road that you need things to be simple. Some walkies will send numbers with just one keypress, while others may make you press up to six buttons just to get to the number you want! If you have to do that, why bother even to have an auto dialer? You might just as well send the numbers manually.

Before you buy an HT, check this feature carefully if you intend to do much autopatching, and especially if you are going to use the radio while driving. Remember, it doesn't pay to worry too much over the difficulty of entering numbers into the memories; pay attention to what it takes to send them. By the way, all autodialer rigs also let you send numbers manually, just in case you need to send one you haven't previously programmed. Come to think of it, there is one exception to that. Some walkies that have no keypads still let you send DTMF, but they require you to enter the numbers into

memory first, using various button and dial knob combinations.

## Beep Me

Many new rigs offer a selective calling feature named DTMF squelch. Basically, it lets you set up combinations of numbers that must be sent before your radio will open its squelch. Also, your radio can send a quick sequence every time you key it, in order to open the other ham's DTMF squelch. Amazingly, this system is fairly standardized; most HTs will open others, even if they're made by different manufacturers.

When the feature first appeared, it was an option. Now, it's usually included. Do you need it? Frankly, no. Many repeaters in the US won't pass received DTMF tones back out their transmitters, in order to foil jammers who want to get the autopatch activation and repeater control codes. In fact, I'll venture that *most* repeaters won't pass the tones, a refusal that limits the use of DTMF squelch to simplex operation. Sure, you can use it at hamfests, and it could be used in special-event and disaster nets (though I haven't seen that done). Chances are, though, you'll never use it at all. If you really need selective calling at a hamfest, you can use CTCSS tones, and you can also use those through most repeaters. So, don't waste your money paying more for a radio that includes DTMF squelch, and don't eliminate a model from consideration because it lacks the feature.

## Save It

Another common feature is the battery saver, and this one's very handy. Battery savers are software programs, built into the radio's microprocessors, which turn the rig on and off, checking periodically to see if any action has occurred that merits keeping the radio awake. Typically, you can set the interval from between about 1/2 second to 3 or

more seconds. Between 0.8 and 1.5 seconds is optimum. Using the battery saver can reduce the standby current drain by a ratio of between four and ten to one! That's a big difference, and it really helps your battery last a long time when you're monitoring, especially if the channel is quiet much of the time. As soon as the radio senses a signal, it wakes up and stays on continuously, until there's no signal for a few seconds. Then the rig goes back to sleep. It really works, and you'll hardly notice its operation.

The downside of using the battery saver is that you might miss up to a second or so of the beginning of a transmission, because it could start while the radio is asleep. For normal voice communication, that's not usually a problem. If you're using the HT for packet (data) radio work, though, it can prevent proper operation. So, there's always a way to turn the saver off, keeping the rig awake at all times.

## Bye Bye

Another way to save your battery is with the auto-power-off function, which shuts the rig off completely if there's been no activity for a period of time you select, typically from 1/2 hour to 2 hours. The idea is to "second guess" yourself; did you leave it on by mistake? The definition of "activity," though, varies from radio to radio. Some manufacturers program the HT to shut off only if you press no buttons and the radio also hears nothing for the required period. Others, however, design it to shut off even if the rig *does* receive signals, as long as you don't press the buttons. Both approaches have their good and bad points, and there's no clear winner here. All the radios give you a warning sound before shutting the set down, but some disable the warning if you have the keypad beeper turned off, which I usually do (I find them annoying). I've heard hams who swear by the auto-power-off function, but I don't care for it. I keep mine disabled and simply turn the radio off when I'm done with it! I got into that habit after I purchased my first rig, which included APO, and it turned itself off during a long period of silent monitoring. I was waiting for a friend's call, and it never came, thanks to my radio being off. I never used the feature again.

## AM Receive

Many new 2 meter and dual-band HTs include an AM detector for use on the aircraft band. That's nice if you want to listen to airplane traffic; otherwise, there's no use for it.

Some radios make you turn it on manually, whereas others do it for you whenever you tune to the aircraft frequencies.

## Headache #144

Many dual-band HTs let you listen to two frequencies at once! I don't mean in the time-shared "priority watch" style; these things actually run both receivers at the same time, and can even continue receiving on one band while you're transmitting on the other. Although the idea started out requiring the two channels to be on separate bands, most newer rigs also let you listen to two on the same band. This feature can be handy when you want to yack while listening for a call. The downside is that, if one band becomes active while you're talking on the other, the audio from the receiver will get into the microphone and be retransmitted on the other band! It can get really confusing to be receiving one conversation while transmitting as part of another. Some rigs disable the second receiver while you talk; others don't. Mine doesn't, and it's caused me much confusion. So, whenever I use this feature, I turn the second band off while engaging in a QSO. It is kind of cool, though, to monitor two repeaters at once.

## Getting Cross

Many dual-band walkies include a crossband repeat function. What this does is retransmit on one band whatever is received on the other. What's the point? Well, it lets you use the radio as a repeater! That's great for a mobile rig; you can use your dual-band HT in the mall, crossband-repeat through your mobile out in the parking lot, and hit repeaters you'd never reach directly from the HT. Using an HT itself as a crossband repeater isn't so great, though, because the nearly constant transmitting gets it so hot that it can severely damage the radio if you're not careful. So, while I love having that feature on a mobile rig, I think it's fairly useless on an HT. Remember, you only need it on the radio through which you're repeating; any dual-band HT can be used at the end of the link.

Well, I can't believe it, but I think we've finally covered most of the functions on today's walkies. There are some more, such as clocks and timers, but they're not that important or useful. I'm sure you'll have fun with your HT operation; I find it one of the most enjoyable parts of ham radio. Until next time, 73 from KB1UM.

## Upgrade ... Don't Stop Now

Continued from page 21

To hook up the PK-12 to an NMEA 0183 output, the GPS receiver is connected to pin 2 of the RS-232 connector, and the ground connected to pin 7. If this doesn't work, refer to the APRS "read me" subdirectory and read the GPS file for assistance. The AEA PK-12 sells for only \$129 and worked well during our evaluations.

Kantronics also has their KPC-3 GPS system, along with GPS firmware updates for those who already own the model for \$19.95. A beacon time delay can be programmed if you are using several KPC3s in the field. Kantronics does not manufacture an APRS adapter cable at this time, but may do so in the near future. The Kantronics TNC sells for approximately \$119.95.

"Using GPS is a lot of fun when tracking your own or a friend's position as they drive around town," comments Jim WB6HAG, showing off his color laptop hooked into a GPS and tied together with the AEA PK-12. "I have seen hams use this for transmitter hunting, and it lets you readily see who is where as they are driving around looking for the hidden T," adds WB6HAG.

If you're not into hooking up everything yourself without plenty of documentation, an instruction manual for assembling an amateur radio GPS reporting/mapping system is available from Jim Carter WB6HAG, 2029 W. Hall, Santa Ana, CA 92704. Send a SASE for more information.

As packet radio attracts more newcomers into the hobby of amateur radio, automatic position reporting from inexpensive GPS receivers may soon be the latest "must have" equipment. **RF**

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# Antennas, etc.

by Joseph J. Carr K4IPV

## Vertical Antennas—Part 2

Long-distance signal propagation in the HF region depends upon the ionospheric phenomena called "skip." In this type of propagation, the signal leaves the transmitting antenna at some angle with respect to the Earth's surface, called the angle of radiation, and enters the ionosphere where it is refracted back to Earth at a distance from the transmitting station. The signal in the zone between the outer edge of the antenna's ground wave region and the distant skip point is weak or nonexistent.

## Angles and Zones

The distance covered by the signal on each skip is a function of the angle of radiation. For example, an angle of 10 degrees is elevated above the horizon 10 degrees. Shorter distances are found when the angle of radiation is increased. At an angle of about 30 degrees, for example, the distance per skip is only a few hundred miles.

Although one might expect on first blush to see a single line on a graph of this phenomenon, there is actually a zone of distances. This exists because the ionosphere is found at different altitudes at different times of the day and different seasons of the year. Generally, however, in the absence of special-event phenomena in the ionosphere we can expect from 1,500 to 2,500 miles per bounce in the HF bands for low angles of radiation. Note, for example, that for a signal only a degree or two above the horizon the skip distance is maximum.

At greater distances, the signal will make multiple hops. Given a situation where the skip distance is 2,500 miles, covering a distance of 7,500 miles requires three hops. Unfortunately, there is a signal strength loss on each hop of at least 3 to 6 dB, so we can expect the distant signal to be attenuated from making multiple hops between the Earth's surface and the

ionosphere. For maximizing distance, therefore, we need to minimize the angle of radiation.

So what is the ideal angle of radiation? It is standard—but actually erroneous—wisdom amongst Amateur radio operators that the lower the angle of radiation, the better the antenna. That statement is only true if long distance is wanted, so it reflects a strong bias toward the DX community. The correct answer to the question is: "It depends . . . on where you want the signal to go." For example, the author lives in Virginia. If I want to communicate with stations in the Carolinas or New England, then it would behoove me to select a high angle of radiation, so that the signal will land in those regions. But if I wanted to work stations in Europe or Africa or South America, then a low angle of radiation is required. Because of the difference in performance between high and low angles of radiation, some stations have two antennas for each band: one each for high and low angles of radiation.

## Antennas and Angles

Figure 1 shows a signal from a hypothetical antenna in order to show what angle is meant by "angle of radiation." The beam from the antenna is elevated above the horizon (represented by the horizontal "tangent to horizon" line). The angle of radiation,  $\alpha$ , is the angle between the tangent line and the center of the beam. This angle is not to be confused with the beamwidth, which is also an angle. Beamwidth refers to the thickness of the main lobe of the signal between points where the field strength is -3 dB down from the maximum signal

(the max signal is along the line).

The angle of radiation for a vertical antenna, hence the shape of the hypothetical "doughnut" radiation pattern, is a function of the electrical length of the antenna (note: "length" in terms of vertical antennas is the same as "height," and is sometimes expressed in degrees or wavelength, as well as feet and/or meters). Note that the quarter-wavelength antenna has the highest angle of radiation, as well as the lowest gain of the three cases. The 5/8-wavelength antenna (see Figure 2) is both the lowest angle of radiation and the highest gain (compared with isotropic or quarter-wavelength verticals).

The feedpoint impedance of the 5/8-wavelength vertical antenna is not easily matched to standard coaxial cable, so a matching section is usually used; these are shown as L1 and L2 in Figure 2. The lengths can be calculated from the equations in Figure 2. If the frequency is specified in megahertz, then the length is in feet.

The vertical dipole antenna is used in many locations where it is impossible to properly mount a horizontal dipole, or where a roof- or mast-mounted antenna is impossible to install due to either logistics or a hostile landlord and/or homeowners' association. Some row-house and town-house dwellers, for example, have been successful with the vertical dipole (Figure 3). In the 1950s and 1960s, the vertical dipole was popular amongst European Amateurs because of space restrictions found in many of those locations.

The construction of the vertical dipole is relatively straightforward. One must find or build a vertical support structure. In the case shown in Figure 3, the support can be a wooden beam jutting out from the house, a tree limb, and so forth. Ropes and insulators at either end support the wire elements and keep the antenna taut. If your home is not metal

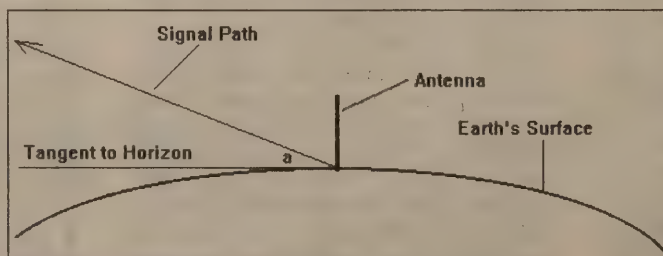


Figure 1. Angle of radiation.

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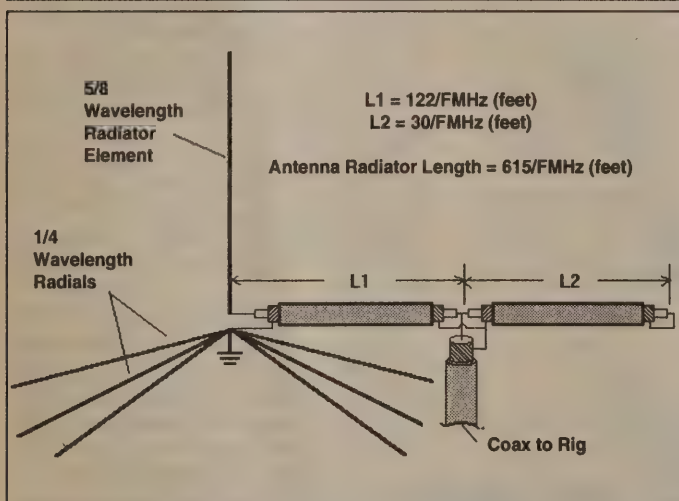


Figure 2. 5/8-wavelength vertical.

sided, and if it is high enough, then a support from the roof structure (or soffits) will make a proper reinforcement.

One problem with the vertical dipole, and one that liability-conscious people need to consider, is that a high-impedance voltage node is found at the ends of a half-wavelength dipole. Anyone touching the antenna will likely receive a nasty RF burn or shock from this antenna.

Verticals do not perform like a

massive beam antenna, but they are easily erected on spacially limited urban and suburban lots. They can also be erected on the roof of a house. I remember one guy, who in the mid-1960s lived in downtown Washington, DC, used a commercial vertical antenna on the roof, with a system of radials laid out on the rooftop (with the manager's permission). With a 50-watt CW transmitter he managed to work DXCC (100 countries!) as a Novice.

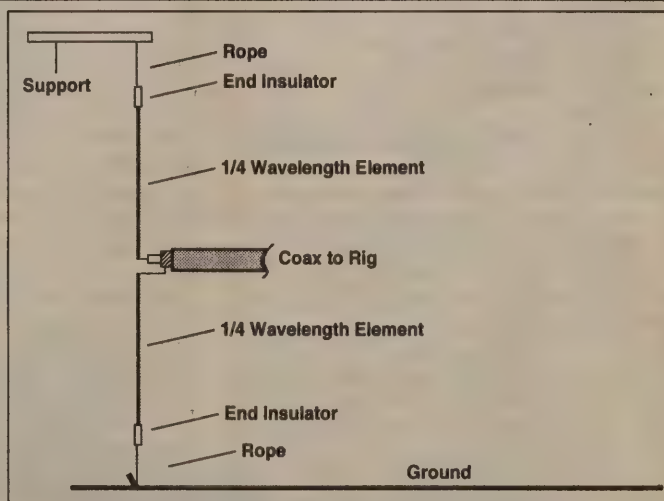


Figure 3. Vertical half-wavelength dipole.

### Antenna Lengths by Software

If you want an easy way to calculate vertical lengths, as well as the lengths of a number of other antenna types, you might want to consider using the Antlers software. The MS-DOS version is \$20, while the more capable Windows version is \$30. You can obtain these programs from me at P.O. Box 1099, Falls Church, VA, 22041.

RF



# What's Next?

by Carole Perry WB2MGP

## Handle with Care

Last year one of my eighth-grade ham radio classes decided to do a little play as their creative project for the term. This particular class was composed mostly of children from the drama class at our school. I always let the students pick one creative project that encompasses some facet of ham radio. You would be amazed at the innovative ideas the children have.

With the help of our Drama teacher, the eighth graders found a play in *Scholastic Magazine, Inc.* by Carol Ellis entitled *Handle with Care*. We modified the CB lingo to be more appropriate to our needs. I present you with scene 1 of this play to use as you see fit with youngsters in a classroom, group, or camp setting. We all loved doing it and presenting it to the other classes.

### The Cast:

Amy—Goldilocks

Ralph—Dynamite Dan

Curtis—Ralph's best friend

Fig Newton—Truck driver

Green Giant—Boy on the CB

Joanne—Amy's cousin

Loony Tunes—Girl on the CB

Mel Taylor—Amy's uncle

Orange Peel—Girl on the CB

Sarah—Curtis's girlfriend

At the party: First girl (1 line); Second girl (1 line)

Scene 1: Ralph's room. On the table next to the desk is a CB radio. Ralph is sitting in front of it, turning the dial. Curtis relaxes on the bed. A voice comes over the CB.

Fig Newton: Hey, good buddies, out there in CB land. Do any of you have your ears on? Come on.

Ralph: This is Dynamite Dan and I'm all ears. Who am I talking to? Back to you.

Fig Newton: It's Fig Newton, D.D.

Curtis (laughing): Fig Newton?! Ralph (into the mike): Hi, Fig, what's happening?

Fig Newton: I'm stuck like molasses on Airport Road.

Ralph: What happened?

Fig Newton: Some ding-a-ling drove under an overpass. Only he forgot that his rig wouldn't



Photo A. The eighth graders had fun working on the script, constructing the set, and making props.

clear it. He's not going anywhere, and neither are the rest of us.

Curtis: Hey, Ralph, leave that thing alone a minute, will you?

Ralph (into the mike): Got to go now, Fig. Hang in there. I'm gone. (Ralph puts down his mike, but leaves the CB on. There is a steady drone of CB conversation in the background.)

Curtis: You're turning into a real CB freak, you know that?

Ralph: So what? It's fun. I get a kick out of meeting different people and talking to them.

Curtis: You could have fooled me. If you like people so much, why don't you have a date for the party yet?

Ralph: I've got two days left.

Curtis: You could have two months and you still wouldn't have the nerve



Photo B. Sixth-grader Louis tries out for the part of the radio operator for next term.

to ask anyone.

Ralph: I don't have to have a date, do I? It's just going to be a bunch of kids in the park. I didn't see any line on the invitation that said, "people without dates not admitted."

Curtis: OK. But you might have fun with a date. Anyway, you still haven't answered my question. How come you can talk over the CB to total strangers when you barely open your mouth with a group of friends?

Ralph: I don't know. The CB's different. It's like . . . (Suddenly a girl's voice comes over the CB. She sounds upset.)

Amy: Hello? Uh . . . breaker, breaker? Can anybody hear me? I hope?

Curtis: Hey, this sounds interesting. Turn it up. (Ralph turns up the CB as Orange Peel answers Amy.)

Orange Peel: This is Orange Peel. I copy. Back to you.

Amy: Oh, thank goodness! I'm sorry to bother you, but I need help.

Curtis: A damsel in distress—you didn't tell me about things like this.

Orange Peel: What's the matter, breaker?

Amy: My uncle's not home yet. His plane landed two hours ago, and I can't imagine where he is.

Ralph (into the mike): Break-one-oh. Hey, Orange Peel, I think I can help out.

Curtis: Ralph to the rescue!

Orange Peel: Is that Dynamite Dan?

Ralph: In the flesh. Listen, breaker, I've got the scoop on your uncle. I've just heard there's an incredible traffic jam on Airport Road.

Amy: Was there a crash?

Ralph: No, no. A truck got stuck. Your uncle's probably sitting in his car, waiting for the highway to open up.

Amy: Oh, that's a relief. I was getting worried.

Ralph: Never fear, Dynamite Dan is here.

Curtis: Very clever, Ralph. Now find out her name. She sounds cute.

Ralph (to Curtis): Sounds cute? How . . .

Curtis: Just ask her!

Ralph: Yeah, right! (into the mike) Breaker, are you still there?

Amy: Yes, I'm here.  
 Ralph: I hate to keep calling you breaker. Do you have a handle?  
 Amy: A handle? Oh! You mean a CB name . . . how about Goldilocks? My uncle calls me that.  
 Curtis: Fantastic!  
 Amy: Thanks again for your help, Dynamite. You, too, Orange Peel.

Orange Peel: That's OK., Goldilocks. Come on again sometime and we'll talk. I'm gone.

Amy: What? You're what?  
 Green Giant: She's gone. Bugged out. Left the channel.

Amy: Who's that?  
 Green Giant: It's the Green Giant, Goldilocks. You can stop worrying about your uncle now and talk to me awhile.

Ralph (to Curtis): The Green Giant strikes again.

Amy: Thanks, but I was talking to Dynamite Dan.

Green Giant: Sounds like he's gone, Goldi. It's just you and me.

Curtis: Go on, Ralph. Don't let the Green Giant scare you off.

Ralph (to Curtis): I can handle it. (In-to the mike) Not true, G.G. My ears are wide open.

Green Giant: So's your mouth, D.D.

Ralph: G.G., you're a loser. Why don't you take your lollipop and hang it?

Amy: Way to go, Dynamite!

Curtis: Awwright!

Green Giant: Okay. But be warned: the Green Giant will return.

Amy: Hi, Dynamite Dan.

Ralph: Hi, Goldi. Why haven't I ever heard you before?

Amy: This is the first time I've used a CB. It's my uncle's. I'm staying with him.

Curtis: How long? Ask her how long?!

Amy: Oh! Listen, Dynamite, somebody just came in. I've got to go . . . uh . . . I'm gone.

Ralph: Goldilocks? Goldilocks? (She doesn't answer.)

Curtis: You blew it, Ralph. You don't even know how long she'll be here. You don't even know her name!

Ralph: Sure I do. It's Goldilocks. I can call her back.

Curtis: Well, you'd better hurry, for all you know, she's leaving tomorrow.

There are five scenes in this delightful teen-aged drama about teenagers having fun on the radio. If you would like a copy of the entire play, just send me a SASE along with your request and I'll be happy to send it right out. You might consider incorporating fun projects like this into your radio curriculum. It gives the instructor the opportunity of including all the students in a very enjoyable endeavor. Have fun! Write to Carole Perry, P.O. Box 131646, Staten Island, NY 10313-0006.

RF

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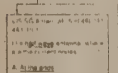
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CIRCLE 193 ON READER SERVICE CARD



# Radio Magic

by Michael Bryce WB8VGE

## Trial and Error—A Safer Way

There is nothing I enjoy more than sitting down at the work bench and tinkering with a few electronic parts. In the past, this meant soldering and unsoldering the same part in and out of a test circuit. This resulted in a twisted and cooked part or two.

Then came along the solderless perf board. You could change a part in the circuit as fast as you could move your fingers. Even using this system meant a lot of trial and error testing. You installed a different value of resistor and then checked the result of the change. Sometimes the results were so off base that a small wisp of smoke was produced. Of course, that always produced an instant toasted critter in place of the 100-ohm resistor you used.

It's lucky for us that electronics conform to many of the laws of nature. No matter what you do or how you do it, Ohm's law will always be Ohm's law. And since Ohm's law, as well as countless others, are based on a mathematical formula, we can use a computer to crunch numbers all day long—without cooking a single resistor in the process.

## Impact of the Computer

Computers have had such an impact on ham radio that you would have to look hard for a shack that does not have at least one computer in it. Why, I can remember when the first TRS-80 computers were being used to decode RTTY. Utilities for me back then were gas, water, and electric! Now I have six different computers in my shack doing all sorts of strange and various tasks. However, there is one area in which computers are doing a slick job: electronic circuit design.

Now I'm not talking about a drawing program or PC board layout program. I'm referring to software that will show you what happens to a circuit as you design it. Some of the software will display the results in a graphical form up to and including a real-time oscilloscope. Others are rather basic, with just a text output. In either case, the results will save you time, money, and parts! Let's look at some of the software available to you.

Electronic simulation software can be broken down into two groups. The first group will allow you to design a circuit and then play "what if" as you change the values of components. You can see the results instantly.

The other group is slanted toward data collection. A special card is required for most applications; however, some software programs will allow you to tie directly into a computer. And just to make things a bit hazy, some data collection software emulates standard test gear such as an oscilloscope and digital VOMs.

It's been said before that nobody ever got fired for buying IBM. So true. But, I got fired. Of all of the computers in my shack, all but two are Apple Macintosh. The pickings are a bit thin for electronic simulation programs on the Mac, but what is out there is extremely slick. If you have a DOS or Windows machine, you have a larger selection of software from which to pick.

## Software Programs

Some of the best software has been around for some time. The simple text-based "equation solvers" were easy to code using a variety of BASIC. These programs usually compute the value of a missing component. A classic example would be to compute the length of a dipole at various frequencies. There are thousands of programs like this to help you solve problems dealing with series and parallel resistors.

One of my favorites is a program from BAH that contains dozens of smaller modules to solve everything from resonant frequency of a vertical to impedance matching of gamma hairpins. It's cheap, too. The shareware fee is only \$5. The program takes a bit to become accustomed to, as BAH uses its own style of programming. The BAH is written in GWBasic.

Moving up the ladder, you can select from such programs as SPICE, MathCad, and the new one offered by the ARRL. All of these programs allow real-time simulation of electronic circuits.

Learning by doing is always a lot of fun. Especially when you can have

thousands of parts, some every exotic, without keeping an inventory. You can't cook a 7400 IC if you do something wrong on the computer simulation.

On the down side, you still should put the circuit together using real-world parts, after you have the logic debugged by the computer. Such things as PC board capacitance, lead length, and physical placement of the components must be taken into account.

So, how do you start using your computer to help design your next electronic project? Well, let's assume you have enough computer power to support the software. Some of the early versions will work on an 8088-based machine. As you move up into more complex software, you'll need a faster machine. It's interesting to note that some of the older software written for the old 8088 machines won't run correctly on the new 486 computers.

Here's the deal to help you get started. I have collected some electronic design software for the IBM-based computers. Almost all of it is shareware. If you send me a formatted 1.4 meg 3.5-inch disk, I'll fill it up with goodies. Send only a 3.5-inch disk, right now; I can't use the high-density 5 1/4 disks.

If you have a Macintosh, and would like to see my SunCad II program, then send a formatted MAC disk and I will make a copy for you. I will also put on it some novel MAC programs for use with ham radio.

In either case, also send enough postage for the disk's return. I'll supply the shipping folder.

The only "catch" is I can't guarantee all of the programs will work on all computers. As most of the software is shareware, some features may be unavailable until you purchase the full version from the company that markets the program. But for the cost of a few stamps, and a disk, it's a great way to spend a rainy afternoon.

Next month, the weather will begin to cool down. We will look at some of the surplus and commercial equipment and how you can use the gear on the ham bands.

RF

# FCC Rules

Continued from page 15

quirements for that class. The Advanced Class was later reinstated as a testable class for new applicants.

The Extra Class was still the highest grade of amateur license, but could only be taken by applicants who had held valid General or higher licenses for two or more years; it wasn't possible for newcomers to go for their Extra without an *experience period*. The Extra Class exam was the familiar 20-wpm code test, plus a special written test on advanced amateur techniques. It was a thorough exam.

Also note that in those days the code test was *both* a sending and receiving test, at the prescribed rate, with at least one minute of *perfect copy* out of the five minutes of total testing time. And this in front of the steely-eyed FCC examiner mentioned earlier!

Nothing has been said so far about frequency privileges for General, Conditional, Advanced, and Extra Classes of license holders. That's because *there were no frequency privilege differences*. Everyone had the same piece of the pie; it was simply a prestige issue that motivated one to aspire to a higher license class. That was enough motivation at the time.

## Paperwork, Paperwork

Things were considerably more complicated back then in a number of different areas. The license was a *two-part* authorization, an *operator's* license and a *station* license. The operator's license was issued when the correct qualifying tests were successfully passed, and the station license authorized the operator to set up his or her station equipment at *one* specified location, though portable and mobile operation were also permitted if the proper procedures were followed. It was also possible to obtain additional station licenses for more than one fixed location, such as one for a home and one for a business location. Here's a direct quote from the ARRL license manual (how would this fly today?): *"It is absolutely essential that both licenses be obtained before an amateur station of any kind is operated.* We wish to emphasize this point and, further, to emphasize that there are no exceptions to the requirement for licenses for any of the kinds of work an amateur is interested in undertaking. Those who, after study, think that the language of the law is such as to permit some

special interpretation which will enable unlicensed operation under certain conditions are warned that the language of the law is air-tight, and no such special interpretations are possible." So there! Perhaps a bit of finality like that is needed these days?

There were some reciprocal agreements in effect beginning in 1964, but before then US citizenship was required to obtain a ham license, as well as the signing of a statement swearing allegiance to the US government and the laws of the land, and promising not to use those radio-transmitting privileges granted to the detriment of our nation or government in any way. It even had to be notarized. Remember that WWII was still fairly fresh in everyone's mind.

Operating portable or mobile in those days was quite a paperwork-juggling act! If you were going on vacation, wanted to operate mobile or portable, and would not be back at your primary residence for more than 48 hours, you had to begin a letter-writing campaign! A *Notice of operation away from authorized location* had to be filed with the FCC's field offices in *each* district that you intended to be traveling within—including your home district—in advance of your planned trip. You were to include your name and callsign, the address of your authorized station location, specific portable locations that you planned to operate from or a detailed mobile itinerary, the dates of the beginning and end of your operation away from the fixed location specified on your license, and an address through which you could be reached. In the case of mobiling in your car, you had to provide its official name (?), registry number, license plate number, and state of issuance. Wow! I played that game a few times. It gave a whole new meaning to "popping off on vacation for a few days with the ol' ham rig"! I often wondered if the FCC Engineer-in-Charge of the various field offices even opened those letters. It sure kept us honest, though.

Logging all transmissions was a big thing back then, and not really a bad idea, either. It was generally considered to be an *official station document* and proof of operation—or non-operation—if questions about interference or bootlegged operation ever came up. Logs had to have very specific information entered into them and were assumed to be made available at the request of the FCC at any time. Theoretically, you were supposed to log each activation of

your transmitter into an antenna. Even low-power radio control transmitters required log keeping and CW identification every 10 minutes, by the way. Keeping a log while operating mobile was quite tricky—and at times a dangerous thing. I was happy to see that one disappear.

If you were visiting a fellow ham, you had to operate under his or her callsign and only to the extent of that person's license privileges. Remember, the equipment itself was licensed under the station authorization license. An Extra visiting a Novice had to stay within the Novice bands. When that Novice visited the home station of the Extra, the Novice had to stay within the Novice bands, and had to keep the station under 75 watts and under crystal control when the Novice was the control operator. A Novice could speak over the microphone of the Extra, but the station had to be under the *control* of the Extra at the time of operation. You dutifully logged anyone's name who spoke over the mike of your station.

No codes or ciphers were permitted back then. RTTY, CW, fast- and slow-scan TV, facsimile, and so forth, were permitted, but no ASCII or binary encoded data; that all came later. Packet, AMTOR, and Factor were not even heard of, nor would they have been permitted. English was the required language—to be on the safe side—over the ham bands in this country, and it makes sense if viewed from the standpoint of the FCC's ability to monitor what was going on within our frequency band allocations. Things have eased up quite a bit since then.

I hope that you've enjoyed this brief trip into the bygone days of ham radio regulations as much as I did putting it together. From the foregoing text, you can see that deregulation has certainly been visited upon the ham community, at least as much as in other areas in which our government exercises control. Has it all been for the best? That's a question only you can answer for yourself. There are always pluses and minuses to every change in regulation in every field of endeavor. For the most part, I'm not unhappy with the way the rules and regulations are today, as long as we radio amateurs police ourselves and can positively influence those few who ignore the fact that every privilege carries with it a corresponding responsibility. Our licenses are indeed privileges; we have no inevitable right to their continuation if we prove ourselves not worthy of them.

RF

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar, and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

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Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

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So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using.

Send your ads and payment to Joyce Bocash, **Radio Fun Flea Market**, 70 Route 202N, Peterborough NH 03458 and get set for the phone calls.

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# Activities Calendar

compiled by Joyce Sawtelle

Send your announcements to: **Radio Fun Activities Calendar**, 70 Route 202 N, Peterborough, NH 03458. We'll print as many as space allows, on a "first come-first listed" basis.

## AUG 26-27

**WOODLAND PARK, CO** The Mountain ARC will hold its 14th annual MARC Campfest-Swapfest at Quaker Ridge Camp, 6.5 miles north of Woodland Park city center, on Hwy. 67 North (M.P. 82.5). Advance reg. essential; write to MARC, P.O. Box 1012, Woodland Park CO 80866-1012, promptly. Send an SASE for info sheet. Or, call Don Chamberlain AA0NW, (719) 687-3692; Fred NOPKA or Patty NOPSD, (719) 687-9727.

## AUG 27

**CHICAGO, IL** Chicago ARC will hold the Summer Hamfest in Oak Brook Terrace IL, 8 AM-3 PM; set-up at 6 AM. Entrance at Park View Dr., north of Cermack Rd. (22nd St.). Talk-in on 147.255(+) and 444.825(+). Call George at (312) 545-4740 or 545-3622; or leave a message on (312) 666-1606. Send written requests to CARC, 5631 W. Irvingpark Rd., Chicago IL 60634. Please include a phone number and a time to call.

**CORUNNA, MI** A Five County Amateur Radio/Computer Swap 'N Shop will begin at 8 AM at Shiawassee County Fairgrounds, 2900 E. Hibbard Rd. Setup at 6 AM. Flea Market. Trunk Sales. Talk-in on 147.020(+), or 146.520 simplex. For info, contact Jan, (517) 893-3475. Sponsors: Bay Area ARC; Genesee County RC; Lapeer ARA; Mid-Michigan Wireless Assn.; and Shiawassee ARA.

**FOWLerville, MI** The Livingston County HamFair at Fowlerville Fairgrounds, Grand River Rd. (M43). VE Exams. Ham/Computer/Electronic Equip., new and used. Covered Trunk Sales. Flea Market. Time: 8 AM-3 PM. Setup at 6 AM. Talk-in on 146.680(-). When writing, send SASE. Contact LARK, P.O. Box

283, Howell MI 48843; or call John, (517) 548-1412.

**LEBANON, TN** A Special Event will be sponsored by the Short Mountain Rptr. Club, 7 AM-3 PM at Cedars of Lebanon State Park, US Hwy. 231, 7 mi. South of I-40. Outdoors only. Bring your own tables (spaces first-come, first-served). For details, contact Thomas Page AD4AI, P.O. Box 2741, Lebanon TN 37088-2741. Tel. (615) 449-5610.

**MATAMORAS, PA** The Tri-State ARC Hamfest will be held at Matamoras Airport Park (RT. 84, exit 11, go to Seventh St.). Talk-in on 145.35, 146.76 pl 100, 146.52. Setup at 7:15 AM. Buyers 8 AM. Electronic, ham radio, and computer equipment. Contact Paul KD3L, (717) 491-4808 after 1 PM; or Bob KB2TBY, (914) 856-5571 after 5 PM.

**WOODSTOCK, IL** The Tri-County Radio Group, Inc. will hold its Hamfest and Computer Show at the McHenry County Fairgrounds (north of RTE 14 on RTE 47). Set-up at 6:30 AM Sun., Sat. setup by appointment. Talk-in on 146.52 simplex. Reservation deadline is Aug. 13th. Contact T.C.R.G., P.O. Box 3107, Skokie IL 60077-6107; or call Robert N9KXG, (708) 658-1678.

**YONKERS, NY** The Yonkers ARC Hamfest/Computerfest '95 will be held on Main St. at the Yonkers Municipal Parking Garage, 9 AM-3 PM. Setup at 7:30 AM. AC power available with pre-reg. Talk-in on 146.865/R and 440.150/R. Contact Jim N2ONM, (914) 969-5182.

## SEP 1-3

**COSTA MESA, CA** The ARRL Southwestern Div. Convention (HAMCON '95) will be held aboard the Queen Mary, Long Beach CA. Contact Chairman Nate Brightman K6OSC, (310) 427-5123.

## SEP 2

**INDIANAPOLIS, IN** The Hoosier Hamfest and Computer Show will be held 8 AM-3 PM at the Indianapolis Nat'l Guard Armory, Holt Rd. and Minnesota, off I-70. Sponsor: Electronic Applications Radio Service (EARS, Inc.). Largest Vendor Display in the area. Setup 6 AM-8 AM. Talk-in on 145.250 Indianapolis. Contact Marty Hensley KA9PCT, 7205 Mohawk Ln., Indianapolis IN 46260. Tel. (317) 253-7985 eves.

## SEP 2-3

**ALAMOGORDO, NM** The 11th Annual Alamogordo ARC Hamfest will be held at Otero County Fairgrounds, White Sands Blvd. VE Exams 9 AM Sep. 3rd.; contact Jim Patton N7IOM, (505) 439-8349. Register with Bob Bradford N5SUO, (505) 434-1000. For details, contact Mary Moore KB5ITH, (505) 437-0145.

## SPECIAL EVENT STATIONS

### AUG 19

**FRANKFORT, NY** The Fort Herkimer ARC will operate KB2UYI, 1400Z-2200Z to commemorate the annual Herkimer County Fair. Operation will be in the General portion of 20m phone, and on 40m, the Novice CW portion, General CW, and phone portions, and 2m packet. For a certificate, send QSL/SWL and a 9" x 12" SASE to KB2YI c/o John Reed, 617 Jeffrey St., Herkimer NY 13350.

### AUG 18-SEP 4

**TORONTO, ONT., CANADA** The VE3CNE Committee will operate Station VE3CNE in conjunction with the Canadian Nat'l. Exhibition. All Amateurs visiting Toronto are invited to come to Exhibition Place and operate the station. The station will be located at the International Pavilion, just inside the Princes' Gates at the east end of Exhibition Park. Operation will be daily from 10 AM-10 PM local time. During the day the local 80 and 40 meter phone nets will tell

you where to find VE3CNE. CW: 80m 3.645-3.700, 40m 7.045-7.145, 20m 14.035-14.055, 15m 21.045-21.145. SSB: 80m 3.745-3.865, 40m 7.065-7.235, 20m 14.145-14.245, 15m 21.300-21.400. VE3CNE will also be found on packet, VE3CNE @ VA3BBS, and on the local rpters. QSL cards will be sent to all contacts via the QSL Bureau.

### AUG 19-20

**BATAVIA, NY** The Genesee Radio Amateurs will operate W2RCX 1300 UTC-2100 UTC Aug. 19th and Aug. 20th, to celebrate the 15th annual "1941 Wings of Eagles Airshow" being held at Genesee County Airport. Operation will be on 40m, 7.250 +/- 20, and on 20m 14.250 +/- 20. For a certificate, send QSL and a 9" x 12" SASE to GRAM, P.O. Box 572, Batavia NY 14020.

**ENGLEWOOD, NJ** The Englewood ARA, Inc. invites all amateurs the world over to take part in the 36th Annual New Jersey QSO Party, 2000 UTC Sat., Aug. 19th-0700 UTC Sun., Aug. 20th; and 1300 UTC Sun., Aug. 20th-0200 UTC Mon., Aug. 21st. Phone and CW are considered the same contest. Logs and comments should be sent to Englewood ARA, Inc., P.O. Box 528, Englewood NJ 07631-0528. Please include a #10 SASE for results. NJ stations are requested to advise EARA by Aug. 1st so that full coverage from all counties can be planned.

**VANCOUVER, WA** The Clark County ARC will operate Club Station W7AIA at the annual Northwest Antique Aircraft Fly-in at Evergreen Flying Field (just east of Vancouver WA). General in the lower portion of the General class band on the 80, 40, 20, 15, HF bands, and 2m, 146.52 for local contacts. The local 147.84/.24 Rptr. may also be monitored. For a certificate/QSL, send a #10 SASE to CCARC, P.O. Box 1424, Vancouver WA 98668. RF

# New Products

compiled by Victor Lapuszynski



## MILESTONE TECHNOLOGIES

Milestone Technologies has announced the release of Version 5 of its popular Morse training program, CODEMASTER. Among the enhancements are the ability to modify the Morse alphabet to include foreign characters or procedural symbols, an emulated "hand key," and an arcade-style character recognition game. The game is more than just fun—it gives the student direct feedback on Morse recognition speed and identifies troublesome characters.

CODEMASTER still retains a learning environment which lets you learn at your own pace and go as far as you want. Milestone Technologies gives a 100% satisfaction guarantee.

CODEMASTER V is available for \$24.95, with an upgrade price of \$12.50 for existing users. Anyone who purchased CODEMASTER v4.5 after March 30th should contact Milestone Technologies for a free upgrade. For more information or to order, contact Marshall Emm, Milestone Technologies, 3140 S. Peoria St. Unit K-156, Aurora, CO 80014-3155; (303) 752-3382, (800) 238-8205 (credit card & COD orders); E-mail: 75230.1405 (CompuServe), Marshall.Emm@Milestone.Cougar.Com (Internet). Or circle Reader Service No. 201.

## RF INDUSTRIES

RF Industries has announced the availability of its space-saving "N" female, 4-hole flange connector. The flange, smaller than the typical flange, enables you to place the connector in areas where the standard flange may not fit. This connector is currently available in two configurations: RFN-1021-4 and RFN-1021-5. The difference between the two is in



the length of the extended dielectric, 1.58" for the RFN-1021-4 and 1.18" for the RFN-1021-4. Both connectors include an O-ring for sealing against moisture and are manufactured at an ISO-9002 facility.

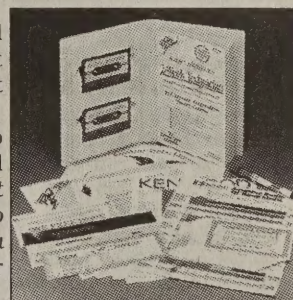
Available from RFI distributors throughout the US, Canada, and Mexico. For more information, contact RF Industries, Ltd., 7610 Miramar Road, San Diego CA 92126-4202; (619) 549-6340, (800) 233-1728 fax: (619) 549-6345. Or circle Reader Service No. 202.

## GORDON WEST RADIO SCHOOL

Gordon West Radio School, Inc., is sharing good deals with elmers and ham instructors. Selected equipment and accessory manufacturers offer free materials to Radio School, Inc., registered instructors, including color glossy frequency wall charts (Icom), color band charts (Yaesu), world maps (Kenwood), one free issue (CQ), \$20 gift certificate (Icom), \$10 gift certificate (Henry Radio), 5% rebate certificate (Comet), and several others. Manufacturers make these certificates and training materials available free to instructors and elmers throughout the country. Postage fee reimbursement is all that is necessary to obtain these materials, one set for each student.

Amateur radio instructors and elmers can also order Gordon West training materials in any quantity at up to half the suggested retail price.

For more information on how to receive free training materials and coupons, contact Gordon West WB6NOA, Gordon West Radio School, 2414 College Drive, Costa Mesa CA 92626; (714) 549-5000. Or circle Reader Service No. 203.



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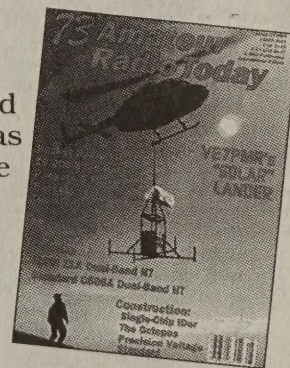
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# Uncle Wayne's Bookshelf

## BOOKS FOR BEGINNERS

**TAB4354 The Beginner's Handbook of Amateur Radio, Third Edition** by Clay Laster W5ZPV, 395 pages. Wonderful book for newcomers. It is basic and well illustrated. Even if you have all the other ham handbooks, you'll still find this one useful. **\$22.00**

**W5GWNC Technician Class License Manual: New No-Code** by Gordon West This book covers everything you need to become a Technician Class Ham. Every question and answer on the examinations is found in this one book. FCC Form 610 application. **\$9.95**

**AR4432 W1FB's Help for New Hams** by Doug DeMaw W1FB Complete for the newcomer. Put together a station and get on the air. **\$10.00**

**AR4920 Introduction to Radio Frequency Design** In this practical book, the author emphasizes use of models and their application to both linear and nonlinear circuits, reviews traditional material stressing the viewpoints taken by the RF designer and illustrates subject material by numerical examples. Includes 3 1/2 inch disk for IBM PC or compatibles. **\$30.00**

## SOFTWARE

**GGTE Morse Tutor** From beginner to Extra Class. Code from 1 to over 100 words per minute. Standard or Farnsworth mode. Create your own drills. Exams conform to FCC requirements. 5 1/4" floppy for IBM PC, XT, AT, PS/2 or compatibles. **\$19.50**

**GG52/5 Morse Tutor 5.25" Disk** **\$19.50**

**GG31/2 Morse Tutor 3.5" Disk** **\$19.50**

**GGADV3 Gold Edition 5.25" Disk** **\$29.95**

**GGADV3 Gold Edition 3.5" Disk** **\$29.95**

**W5GWHO Ham Operator Education Package Software**, Novice—Extra for PC's, contains both 3 1/2" and 5 1/4" disks. **\$39.95**

**W5GWN5W No-Code Ham Radio Software Package for PC's**, contains both 3 1/2" and 5 1/4" disks. **\$29.95**

**Lanze Code Programs—(Available on 5 1/4" \* disk.)** Inexpensive complete study guide code programs for both the C64/128 Commodores and the IBM compatibles. Programs include updated FCC questions, formulas, schematic symbols, diagrams, and simulated (VE) sample test.

	IBM Part#	Commodore Part#	Price
Novice	LZ1BM01	LZCOM01	\$14.95
Tech	LZ1BM02	N.A.**	\$14.95
General	LZ1BM03	N.A.**	\$14.95
Advance	LZ1BM04	N.A.**	\$19.95
Extra	LZ1BM05	LZCOM05	\$19.95

\* Add \$2.00 for 3 1/2" disk. \*\* Not available

## CODE TAPES

**73T06 "The Stickler"** \$5.95

**6+ wpm**—This is the practice tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are set at 13 wpm and spaced at 5 wpm.

**73T13 "Back Breaker"** \$5.95

**13+ wpm**—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per.

**73T20 "Courageous"** \$5.95

**20+ wpm** Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the Extra Class license. We send the code faster than 20 per.

**73T25 "The Mind Boggler"** \$5.95

**25+ wpm** Fiendishly generated by kindly old Uncle Wayne for hams with a strong need for self punishment. Once you've conquered 25 per let Unk know if you need a 50 wpm tape.

## WAYNE WRITES

**WG1 We The People Declare War On Our Lousy Government**—360p soft cover. This is Wayne's report explaining what the major problems are facing both New Hampshire and the country, and proposing simple, inexpensive solutions: a simple way to have government departments happily cut their expenses by 50% within three years; how to cut the cost of incarcerating prisoners by over 90%; how to end welfare; how to reduce the deficit; how to cut medical costs and improve health care; how to cut school costs and improve schools. An absolute steal at \$13.

**WG4 20/20 Foresight**—Twenty 16p updates on the **Declare War** book—320p. Further proposals for solving critical American problems, such as a new approach to financing small businesses, how to finance Russia and other countries and make a profit doing it, the real dope on bioelectromagnetics, a new kind of polytechnical university, a new electronics technology, why Africa is in such a mess, why Perot bombed, how to have tuition-free universities, a plan for making Congress turn honest, etc. Plenty more. Ridiculously priced at \$10.

**AR1995 ARRL 1995 Handbook (71st Ed.)** Features: added DSP, improved treatment of Pi and Pi-L, all new all-digital logic, plus lots more. **\$30.00**

**AR1086-4 ARRL Operating Manual (4th Ed.)** Information on how to make the best use of your station, including: interfacing home computers, OSCAR, VHF-UHF. **\$18.00**

**AR3657 QRP Notebook** by Dave DeMaw W1FB Presents construction projects for the QRP operator. **\$10.00**

**AR3207 W1FB's Design Notebook** by Dave DeMaw W1FB Filled with simple practical projects that can be built using readily available components and common hand tools. **\$10.00**

**AR4042 Solid State Design** Good, basic information, circuit designs and applications; descriptions of receivers, transmitters, power supplies, and test equipment. **\$15.00**

**AR4173 Now You're Talking! All You Need To Get Your First Ham Radio License (2nd Edition)** A complete study guide for the Technician and Novice written exam. Practical information every beginner needs is written clearly and simply and in small doses. **\$19.00**

**AR4971 ARRL Repeater Directory 1995-1996** 19,000+ listings with digipeaters, bandplans, CTCSS (PL/DM) tone chart, frequency coordinators, ARRL special service clubs, and beacon listings from 14 MHz to 24 GHz. **\$7.00**

**AR3398 The DXCC Companion** by Jim Kearman KR1S Spells out in simple, straightforward terms what you need to be a successful DX'er. **\$8.00**

**AR1250 Log Book—Spiral** \$3.50

**AR3177 The ARRL Spread Spectrum Source Book.** From a deceptively simple beginning, a group of experimenters set out to develop first theoretical and later practical systems for spread spectrum communications. This book consists of articles, papers and government reports that document the process whereby amateur spread spectrum progressed from the drawing board to the airwaves. **\$20.00**

**AR3851 Hints and Kinks** Ideas for setting up your gear for comfortable, efficient operation. **\$10.00**

**ARRL License Manuals** Complete FCC question pools with answers.

**AR4181 Technician Class** \$ 6.00

**AR4688 General Class** \$12.00

**AR3274 Advanced Class** \$ 8.00

**AR3282 Extra Class** \$ 8.00

**AR3185 The Satellite Experimenter's Handbook, (2nd Ed.)** by Martin Davidoff K2UBC Expanded and revised. Focusing on satellites built by and for the international radio amateur community. **\$20.00**

**AR2030 Your Gateway to Packet Radio (2nd Ed.)** Tells everything you need to know about this popular new mode. **\$12.00**

**AR4645 Satellite Anthology** The latest information on OSCARs 9 through 13 as well as the RS satellites, the use of digital modes, tracking antennas, RUDAK, microcomputer, and more! **\$10.00**

**AR4483 Weather Satellite Handbook (4th Ed.)** by Dr. Ralph Taggart WA8DQT Expanded and revised to reflect today's weather-fax satellite technology. **\$20.00**

**AR4653 Companion Software for Weather Satellite Handbook** 5 1/4" MS-DOS Floppy. **\$10.00**

**AR2083 Complete DX'er (2nd Ed.)** by Bob Locker W9K1 Learn how to hunt DX and obtain hard-to-get QSL cards. **\$12.00**

**AR3762 Your QRP Operating Companion** No special rigs or expensive equipment to enjoy the excitement and challenge of low-power operating. **\$6.00**

**AR3169 QRP Classics** Compilation of ARRL publications on building receivers, transmitters, transceivers, accessories. **\$12.00**

**AR4270 FCC Rule Book** A must for every active radio amateur. **\$9.00**

**AR0356 Morse Code: The Essential Language** by L. Peter Carron, Jr. W3DKV Expanded and revised in its 2nd edition. How to handle distress calls heard not only on the hambands but on maritime and aircraft frequencies. **\$6.00**

**AR3983 Understanding Basic Electronics** An ARRL book. 314 big pages. This explains everything very simply: the math, DC, AC, transistors, even tubes (wow!). Dirt cheap at \$17. Isn't it about time you understood the fundamentals? **\$17.00**

**WG5 Submarine Life in WWII**—60p. Wayne's story of his adventures on the USS Drum SS-228 on five war patrols in the Pacific in 1943-45. What's it really like on a submarine when you're being depth charged? And what's the day-to-day life on a submarine like? Did you see the movie Das Boot? Exciting stuff and only **\$7.50**.

**WG6 Uncle Wayne's Caribbean Adventures**—96p. Wayne's adventures scuba diving all around the Caribbean, visiting ham operators, and sightseeing. If you're interested in how to travel economically, you'll get some great ideas from this. He starts out with his "Diving, the Wimp Sport." You'll love the visits to 11 islands in 21 days trip. A measly **\$7.50**.

**WG7 Uncle Wayne's Travels**—52p. Wayne travels to Russia, London, Aspen, St. Pierre, Munich, Vienna, Krakow, and Prague without it costing nearly as much as you might think. Cheap for you too, at **\$5.00**.

**WG9 Wayne Talks: 'Dayton'** 1995-90 minute tape. What he would have said if he'd been asked to speak. **\$5.00**

## REFERENCE

**RS-1 The Amateur Radio Mail Order Catalog and Resource Directory, 4th Edition** is the most comprehensive source book for electronic parts, software, and equipment targeted at the radio amateur or serious electronic hobbyist anywhere! Plus a wealth of "value-added" reference material all in 262 pages. 4th Edition clearance at only **\$8.95**. (was \$16.00)

**TAB2701 Transmitter Hunting** by Joseph Moell and Thomas Curlee Radio direction finding simplified. **\$19.95**

**UE202 RTTY Today** by Dave Ingram Modern guide to amateur radioteletype. **\$8.95**

**WGP87158 1995 North American Callbook** The 1995 North American Callbook lists the calls, names, and address information for 500,000+ licensed radio amateurs in all countries of North America. **\$35.00**

**05H24 Radio Handbook, 23rd Ed.** by William I. Orr W6SAJ 840 pages of everything you wanted to know about radio communication. **\$39.95**

**WGP1234 1995 International Callbook** The new 1995 International Callbook lists 500,000+ licensed radio amateurs in the countries outside North America. It covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). **\$35.00**

**W5GWNV No-Code Video, Manual, Part 97 Rules** Learn how to be a ham radio operator. **\$29.95**

**AR4092 Your RTTY/AMTOR Companion** invites you to explore the world of HF digital communications. If you've never operated RTTY or AMTOR before, this book is written especially for you! You won't find complicated technical jargon here. Just information you can use right away. You'll discover how to . . . Assemble your own RTTY/AMTOR station . . . Use RTTY and AMTOR to talk to amateurs throughout the world . . . Compete in RTTY/AMTOR contests . . . Hunt for digital DX. **\$8.00**

**AR3754 Radio Frequency Interference—How to find it and fix it.** Interference problems are challenging, but curable. With the techniques in this book, you can help restore electronic peace in your neighborhood. **\$15.00**

**20N096 How To Read Schematics (4th Ed.)** by Donald E. Herrington Written for the beginner in electronics, but it also contains information valuable to the hobbyist and engineering technician. **\$19.95**

**TAB37109 Secrets of RF Circuit Design** by Joseph J. Carr Written in clear non-technical language, covers everything from antennas to transistors. **\$21.95**

**TAB11065-1 Mastering Radio Frequency Circuits** by Joe Carr, 411 p. If you're interested in learning about radio components and circuits, this book is great! Plus there are a ton of simple circuits you can build. It explains how circuits work, about test equipment, receivers, the works. This will take a lot of the mystery out of how radios work...the easy way. This will be one of your better \$20 ham investments. **\$20.00**

## ANTENNAS

**AR4114 Low Profile Amateur Radio** For the Ham who lives where antennas are frowned upon. From hiding your antenna to operating with low power. This book tells you how to get on the air using these techniques, and others, without calling attention to yourself. **\$8.00**

**UE220 The Easy Wire Antenna Handbook** by Dave Ingram K4TWJ. All of the needed dimensions for a full range of easy to build and erect "sky wires." **\$9.95**

**TAB 3270P Practical Antenna Handbook—Second Edition, 1994**, Joseph Carr; Tab Books. This 560-page book is a real treasure. Starts with the fundamentals of antenna and feedline theory, explains about propagation of all kinds, and then provides a ton of easy antenna construction projects. Covers antennas and feeders for all bands. The explanations are simple and well illustrated, with some math, where it's unavoidable, but it won't bog you down. It even has the ZL-Special antenna, which I've used on 20m with some spectacular DXing success. A low angle of radiation and made it so I could always work the rare stuff first . . . Wayne. **\$26.95**

**AR4734 ARRL Antenna Book** The new 16th Edition represents the best and most highly regarded information on antenna fundamentals, transmission lines, design, and construction of wire antennas. **\$30.00**

**AR0194 Antenna Compendium Vol. 1** Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization. **\$10.00**

**AR2545 Antenna Compendium Vol. 2** Covers verticals, yagis, quads, multiband and broadband systems, antenna selection. **\$12.00**

**AR2626 Companion Software for Antenna Compendium Vol. 2** 5 1/4" MS-DOS floppy. **\$10.00**

**AR4017 Antenna Compendium Vol. 3** More verticals, yagis, quads, plus loops, arrays, mobile, direction finding, controlled currents, computerized, installation, overloads, plus 40 new articles for beginner's to advanced. **\$14.00**

**AR4912 Antenna Compendium Vol. 4** You'll find 38 articles inside, covering a wide range of topics. There are simple, practical antenna projects, and there are heavy duty, theoretical treatments of complex arrays. Bundled inside is an IBM PC-compatible 3.5-inch, 720 kB disk. It contains executable programs and data. **\$20.00**

**AR4661 Antennas and Techniques for Low-Band DXing** can be your ticket to low-band success. Drawing on the experiences of successful DXers and the author's own considerable experience, John Devoldere, ON4UN, shares the tips and techniques that can make the difference between a station that takes part in a contest and one that wins it! **\$20.00**

**AR3819 Physical Design of Yagi Antennas** by David B. Leeson W6QHS provides the tools here to design and build robust Yagi antennas, using sound mechanical engineering principles. You need no longer fear the consequences of wind or ice storms on your antennas. With this information, you can build or "beef up" existing Yagis. **\$20.00**

**AR2618 W1FB's Antenna Notebook** by Dave DeMaw W1FB Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. **\$10.00**

**AR2200 Antenna Impedance Matching** by Wilfred N. Caron Most comprehensive book written on using Smith Charts in solving impedance matching problems. **\$20.00**

**AR0410 Yagi Antenna Design** A Ham Radio series polished and expanded by Dr. Lawson. **\$15.00**

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